THE
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THE BIOLOGIST

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TABLE OF CONTENTS

Personal Glimpses by our new President 5
Retrospect of Phi Sigma 7
The Biological Engineer 9
Mu Chapter 20
Phi Chapter 30
Losses to Phi Sigma 39
Notes on Council Meeting 44
Southern California Has now a place in our Sun 46
How to Write a Good Journal Article 47
Photographic Prints of Leaves 51
Wedding Bells 52
Beta Beta Beta Honorary Biological Society 54
Colonizing Plan of Phi Sigma 55
Report of Inspection of Biological Club of University of South Dakota 57
Chapter Reports 59
Occurrence and Characteristics of Certain Yeasts found in Fermented Honey 65
Suggestions in Making Whole Chick Embryo Mounts 70
Glass Blowing for the Laity 72
Scientific Papers 79
The Grist We Grind 83
Report of National Treasurer 86
Suggestion Sheet 87

CONTRIBUTORS TO THIS ISSUE

DR. PAUL BIGELOW SEARS (Ohio State '16), Professor of Botany, University of Oklahoma now enters upon his initial term of office in Phi Sigma as our president. It is our unanimous feeling that the National Council chose very wisely when they elected Doctor Sears to fill the vacancy. We are grateful to President Sears for having committed himself to this responsible task. A feeling of unified strength has manifested itself throughout the society, keeping pace with our steady and substantial increase in size. Phi Sigma has again been fortuned with strong leadership and the present president, with no exception to the past, will find whole hearted cooperation coupled with efficient team play.

◆

C. L. STEVENS (New Hampshire '27), has consented to write the third contribution appearing under the heading *The Biological Engineer*. This very interesting dissertation on the subject, "The Forester as a Biologist," is the product of much thought and consideration. The author attempts to leave the feeling that our forests are open to intensification even as are our gardens and farm lands. He would have you believe it possible to "intercrop" the trees with certain fur bearing animals, realizing enough by such methods to cover the taxation costs until the time when your stand of timber is marketable. However, the author cautions against ill advised and too hasty generalizations without experimentation.

◆

MARION STILLWELL (University of California '28), ably assisted by her chapter officers, presents a review of the biological departments and their fields of endeavor from the University of California. This work has been no easy task as evidenced by the fact that this chapter, in our largest university and the largest chapter in our society, has been busy with the preparation of this paper since fall. We heartily thank Miss Stillwell and her capable associates for their efforts.

◆

DOROTHY T. SMITH (New Hampshire '26) has coordinated and edited a contribution from the entire chapter upon, "Phi Chapter, of Phi Sigma." Miss Smith is a wide awake and energetic chapter president.

◆

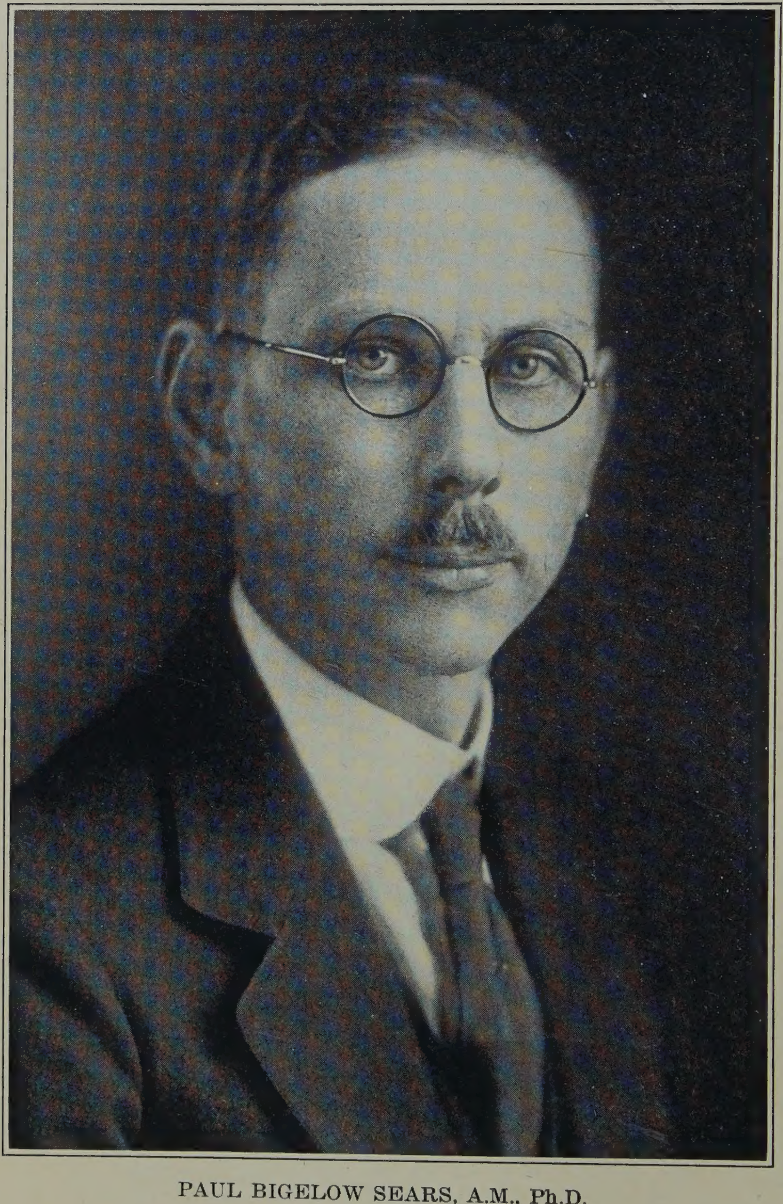
GEORGE E. MARVIN (Wisconsin '26) has recently received publicity from various newspapers in the midwest upon his research work in connection with the factors concerned in the fermentation of honey. His work is briefly presented in this number.

◆

DR. FRANK L. ROBESON and EVERETT F. DAVIS (University of California '24) have worked up an article upon glass blowing. If you enjoy the manufacture of an automatic self-starting siphon as they did—well—"nuf sed."

◆

DONALD G. BARTON (New Hampshire '26), Zoologist, has given helpful suggestions for making Whole Chick Embryo Mounts. Since his paper is the result of considerable of his own experimental work you will find that his directions will materially aid in the preparation of these exceedingly difficult mounts. All our thanks to him for lessening our load.



PAUL BIGELOW SEARS, A.M., Ph.D.
Our Newly Elected President

THE BIOLOGIST

VOLUME X APRIL, 1928 NO. 1

Personal Glimpses By Our New President

I had as lief not be, as live to be
In awe of such a thing as I myself.
—Shakespeare, "Julius Caesar"

OUR overworked editor has asked me for some personal information, and for the name of some colleague who could be relied upon to supplement this information on matters where my natural reticence or modesty might be too great.

But Dr. Davis should have realized what he was doing. In the first place, my old colleagues at Ohio State have seen very little of me for the past ten years. Those at Nebraska know me too well, and those at Oklahoma, where I have been since September, don't know me yet. So if consultants were called in we might not get any better picture than we would without them.

Besides this, Dr. Davis, whether he realized it or not, set before me a literary problem which it is difficult to resist. If we may believe some philosophers, there are no modest men. All men are either vain or conceited. This being the case, presumably the murder will out whenever a man writes anything about himself. Since I am rather curious as to the outcome, here goes.

So far as actual data about me are concerned the essential details may be found upon page 874 of the 4th edition of American Men of Science.*

So far as other matters are concerned, I am a person of quite ordinary abilities to whom have been granted parents, teachers, wife,* and friends quite beyond the ordinary. If I have any gift which is quite my own it has been the pride I have had in them all and a certain knack of getting a great deal from them. As some of my good friends know, this has, at times, involved the capacity to take severe criticism and intellectual punishment in large doses.

From the long days of boyhood when I played baseball because it was the only way to be respectable, felt uncomfortable because I was not a great fullback, and furtively indulged my taste for books and nature, I

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*Sears, Prof. Paul B(igelow), University of Oklahoma, Norman, Okla. Botany. Bucyrus, Ohio, Dec. 17, '91. A.B., B.S., Ohio Wesleyan, '13; A.M., Nebraska, '15; Ph.D., Chicago, '22. Instr. Bot., Ohio State, '15-'19, Asst. Prof., Nebraska, '19-'25; Assoc. Prof., '25-'27; Prof. and head dept., Oklahoma, '27-; U.S.A. '17-18. A.A; Bot. Soc. Amer. (Sec'y gen. sect. '24 to date); Ohio Acad; Nebr. Acad. (pres. '24). Insect galls; vegetation of glaciated Ohio; plant physiology; reproduction and variation; pollen.

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*Marjorie Lea McCutcheon, from Virginia. Graduate of Denison and Ohio State, instructor in English at both schools, and one of the best things I ever did.

have acquired a rather vehement belief that the individual tastes and activities of others, young and old, ought to be respected. I have even learned to respect my own choices in these matters, too late in life, perhaps.

Gradually, as the time has passed, I have come to realize that the impulse to do scientific work is essentially an artistic, creative one; that the significant thing about science, even more than its material benefits, is the mental adventure of those who have created it; and that no field of human knowledge can exist as a thing apart from the other activities of the human spirit.

You may judge, then, how I have come to feel towards that type of "science" and "research" which regiments the spirits and dulls the minds of those who pursue it—which turns out uneducated or half-educated specialists, skillful of hand but numb of mind.

So my cherished hope for Phi Sigma is that she may set herself solidly against all such learned folly and misuse of the tools of science. Let her stand, more firmly than ever, for the stern discipline of the laboratory and field. But in so doing may she insist first that minds be trained for critical thought. Such training can come only from that humane knowledge which is the common property of educated minds throughout the world. To such minds alone comes the capacity to see wholly and to judge soundly.

And in writing this, I have solved my literary puzzle. For the things you have just read are conceits—nothing else!

Read The Biologist

Men

Men are what women marry. They have two hands, two feet, and sometimes two wives, but never more than one collar button or one idea at a time.

Making a husband out of a man is one of the highest plastic arts known to civilization. It requires science, sculpture, common sense, faith, hope and charity, especially charity.

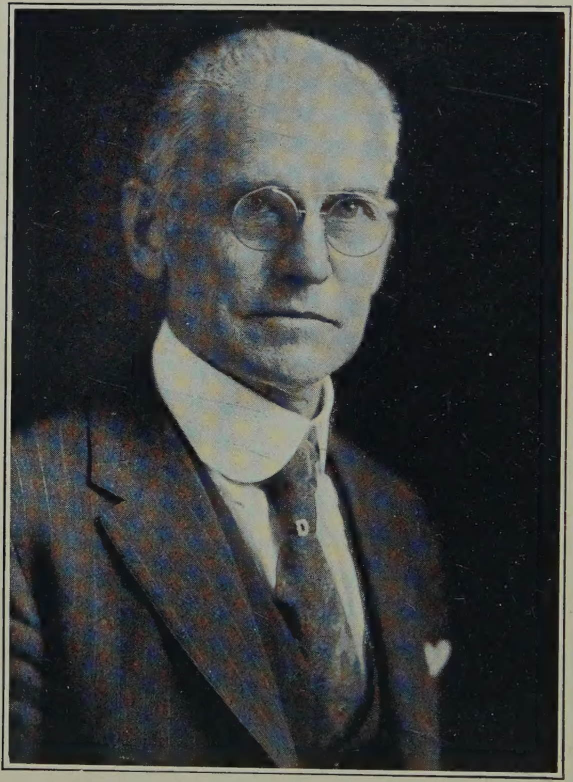
If you flatter a man, you scare him to death, and if you don't, you bore him to death. If you permit him to make love to you, he gets tired in the end—and if you don't permit him to make love to you, he gets tired of you in the beginning.

If you wear gay colors and rouge and a startling hat, he hesitates to take you out—and if you wear a little brown toque and a tailor-made suit, he takes you out and stares all evening at women in gay colors, rouge and startling hats. If you are a clinging vine type, he doubts whether you have a brain and whether you have a heart. If you are silly he longs for a bright mate and if you are brilliant, he longs for a playmate.

If you are popular with other men, he is jealous—and if not, he hesitates to marry a wall-flower.

Oh, darn men anyway!!!

—*Ann Onomyous*



IRA EUGENE CUTLER, Ph.D., LL.D.
Our Retiring President

Retrospect of Phi Sigma

By Fanny Fern Davis

IT was with regret that the Council ultimately accepted the resignation of Professor Ira E. Cutler who, since the fall of 1924, has been President of our organization. Charter member of Epsilon Chapter as he is, and being closely in touch with the progress of the society almost since its inception, he has been peculiarly fitted to assume the duties of his office in Phi Sigma. At this time, therefore, the author finds herself looking back over the history of Phi Sigma, and is amazed at the amount of real progress which has been made by our society in the past three years under the able leadership of Our Council.

A complete retrospect at this time is impossible, but let us consider some of the big steps forward which have been made since the fall of 1924. In the first place, in looking over our chapter roll we find that during these past three years we have added seven new chapters, and dropped our mother chapter, thereby increasing the number of active chapters from 14 to 20; and at the present time we are about to welcome three more groups into our fellowship. Is that not a goodly growth in so short a time?

Moreover, in going over the membership as a whole, we find that the increase in numbers of members in each chapter has been increased in as great if not greater proportion than has the number of chapters. The author can present no better evidence of this point than to call your attention to the following data taken from the files of our society.

Chapter	Total membership in 1924	Total membership today	Date of installation
Alpha	111	109	March 17, 1915
Beta	247	301	June 3, 1916
Delta	81	149	Jan. 27, 1917
Epsilon	23	77	March 5, 1917
Zeta	151	273	May 30, 1917
Eta	48	74	April 20, 1921
Theta	73	131	April 9, 1921
Iota	87	165	May 28, 1921
Kappa	138	218	May 31, 1921
Lambda	72	198	June 4, 1921
Mu	239	406	April 27, 1922
Nu	56	85	May 12, 1922
Xi	54	116	May 3, 1924
Omicron	23	49	May 26, 1924
Pi		40	Jan. 5, 1925
Rho		89	March 28, 1925
Sigma		44	Dec. 4, 1925
Tau		41	March 4, 1926
Upsilon		63	May 7, 1926
Phi		86	May 21, 1926
Chi		27	Feb. 11, 1927
Total membership	1433	2741	

How does the progress of your chapter in this regard compare with that of other chapters, and of our organization as a whole?

Resultant from its growth in size, Phi Sigma has made other strides in advance, foremost among which has been the adoption of the policy of holding biennial National Conventions, the first of which took place in December, 1924, and Washington D. C. This was the goal towards which our leaders had been working for several years. That first assemblage there of delegates from our thirteen chapters was a memorable stepping stone in the history of Phi Sigma and must indeed have been a source of great satisfaction to such members of the Council as Dr. Reed who has been a very vital part of the society since its origin in Ohio State University in the spring of 1915.

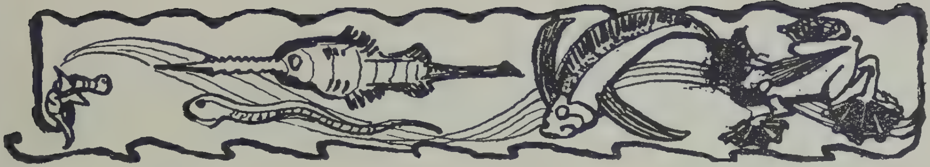
That convention was followed by one in Kansas City in 1925, and another in Philadelphia in 1926. Those of us who have been sufficiently fortunate to have attended all of our conventions have each time been pleased, gratified,—yes, and inspired by the fundamental growth and development of the organization from year to year. Not only has there been a business meeting, but, starting with the convention in 1925 there has been some time allotted for the presentation of scientific papers which have proved to be of considerable interest. The 1928 convention to be held in New York City in connection with the meetings of the A.A.A.S. bids fair to be even more successful than either of the past two as regards this last step,—the presentation of papers, since it has been decided by the Council to devote one entire day to that portion of our convention program.

In pointing out the important stepping stones in the history of our chapter during the last three years, there is one more event that must not be overlooked. That is, that through the efforts of our very capable Secretary, Doctor Reed, it has been possible for our organization to become associated with the A.A.A.S. We hope that this may sometime lead to our affiliation with the same organization.

Such progress as that shown above is possible only when we have complete cooperation of our wide-spread chapters with capable, enthusiastic leaders. One faction alone can not *make* Phi Sigma, nor help her progress. It requires the joint efforts of both factions working as one harmonious whole, one unit, for the progress of Phi Sigma and of her ideal,—the stimulation of interest in biological research among the students both graduate and undergraduate, in our American colleges and universities.

So now as we express our regrets concerning the resignation of Professor Cutler; we turn with new hope and great expectations to Doctor Paul B. Sears, Professor of Botany in the University of Oklahoma, who, along with his many other responsibilities, has graciously accepted these additional ones in connection with Phi Sigma. Being associated with the organization since its very early his-

(Continued to Page 38)



The Biological Engineer

The Forester as a Biologist

By C. L. Stevens, University New Hampshire, (Phi '27)

IT is something of a platitude to say that wild life is increasing in importance almost daily. This is one of the most popular subjects of the present time. Nature study is taught in the public schools. Clubs are formed for the observation, protection or propagation of animals and birds. Books, magazines and publications of all sorts contain nature stories, pictures of wild life, articles bewailing the rapid slaughter of birds and animals, as well as articles on how to raise and tend them, and even advertisements of breeding stock for sale. Public interest has reached an extraordinary pitch in its attention to the conservation of game, and the end is not yet in sight.

This tremendous display cannot help but have a direct effect upon the professional forester. As the guardian of the woodlands he is presumed to have direct contact and intimate acquaintance with all the birds and beasts occurring in his range. And does he possess this knowledge? Not as a general rule. Already a cry has gone out from the United States Forest Service, in an article entitled "Where Is The Forest Biologist?" Syracuse University has recently published a voluminous bulletin on "The Importance of Animals in Forestry." All sorts of positions are opening up for the man who has a fund of technical information on this subject. It is quite significant that the recently appointed head of the U. S. Bureau of Biological Survey is a trained forester.

It is true that wild life deserves all this attention. The fauna of a forest region should certainly be considered as one of its natural resources. The economic importance of fish and game as a source of food has been stressed by many and various writers and will not be considered here. The question of birds vs. insects has also been more or less thoroughly gone into. There is yet another phase from the popular standpoint,—What is the status of wild life as an integral part of the recreational value of the forests? Here is something which cannot be measured in dollars, yet it exists and is of striking importance. Consider the fisherman, for example, who runs into the woods for half a day's fishing, and returns with perhaps a dozen trout. Do those few fish indicate, in any way whatsoever, the quantity of good which that man has received? Could their actual value to his well-being be measured in terms of money? And would he have spent that afternoon in the woods, out of doors, had he known beforehand that there were no fish to be found there? The answers are obvious, but significant.

For those who are not ardent fishermen, the birds and animals provide a strong incentive to get into the forests. It is true that birds can be observed in cities and towns, but there are many species found only in larger areas or in denser stands of trees than the average city park affords, and bird study is a constant and immeasurable source of recreation of the most beneficial sort.

Hunting may be classed with fishing in its appeal, wherein wild life is destroyed that the hunter may have some sort of trophy in addition to his vacation outdoors. Many, however, do not care to kill, and as a substitute for the rifle take along a camera which aims at quite a different sort of trophy, and one bringing a higher and more lasting satisfaction. Wild life photography is a fascinating sport and brings people into the forest at all times of the year. Every species is fair game, there is no bag limit, no license is required and there are no closed seasons. Witness the popularity of the National Parks with their sociable animals, or observe the crowds gathered around the bear cubs now to be found at so many country tea rooms, if you wish a testimony as to the value of wild animals from a recreational standpoint.

There is yet another value to be considered, and that is the vital relation to the forest itself. This relation is neither noticed nor understood by the casual observer. The scientist finds its occurring in his investigations, and now and again the forester encounters it in controlling the wild life as a part of his silvicultural program, but it is highly probable that there is no one who possesses a thorough understanding of the intricate relations between the various phases of nature found in the woodlands.

Since it is the policy now-a-days to cater to the recreational use of forests, and since wild life is obviously such an essential feature of that phase, it is highly important that the forester consider it seriously in the plan of management of his forest. This idea brings up a host of questions, and among them are two which I wish to discuss in this paper: What are the relations of a forester to fish and game? and What are the practical problems he will have to solve in handling his forest with respect to those relations? The answers to these questions will indicate very well the sort of training in Zoology the forester of the future should have,—the knowledge essential for the proper use and development of this resource.

The relations of the forester to wild life may have any one of three aspects: (1) A separate industry may be carried on, one which is not in any way concerned with the business of forestry. (2) Fish and game may be developed as a side line, as an additional source of income, as a means of deriving a profit from such lands as will not pay when handled for forest products alone. (3) It may be considered as an integral part of forest management. The first two of these will be dismissed somewhat briefly, as we are more concerned with the discussion of the third aspect.

1. A Separate Industry. As a separate industry the project may be a fish hatchery, a fur farm, or a game farm on which the animals or birds are raised primarily to sell. A second form is that of a game preserve. Here the object is usually to provide better hunting or fishing for the owners of the land, and the sale value of the animals is not considered. The game refuge or sanctuary is somewhat different from either of the above, in that it is a breeding ground on which no hunting is permitted, and from which as a rule no animals are sold.

Each one of these is in itself an industry distinct from the other two, and each counts its profits in a different way. In all of them, however, the forest is an accessory, more or less necessary as the case may be, and would not ordinarily be considered as anything more than equipment. Cutting and marketing timber is not a part of the project and may, indeed, interfere with the most complete realization of the objects of the business.

2. A Side Line. When a forester undertakes to put an area under management it often happens that a part of it will not produce returns for a considerable period of time. Examples are many, but cutover lands, rocky areas, swamps and marshes suggest themselves, as well as poorly stocked stands and stands of inferior species. On each of these it is possible to establish in a small or temporary way, an arrangement by which the wild life will provide an income. At the least this should cover carrying charges, and at best it should be enough to pay for such intensive treatment as will create the most desirable form of forest in the shortest time, with possibly some surplus earnings.

3. A Part of Management. The business of forestry concerns itself with economics and with silviculture. Only by a successful combination of the two can the business continue. Any phase of the cultivation of wild life must, therefore, be justified from each of these aspects before it can be adopted as an integral part of forest management. Here I would like to digress for a moment to consider some major points in the knowledge essential for the perception and application of the broad principles underlying the handling of plant and animal life in the forest.

The first and most fundamental requisite in this, as in other fields, is a proper point of view. To obtain it, in most cases it will be necessary for the forester to change his concept of the forest itself. His scope must be enlarged, his horizons extended. The forest must take on a deeper significance than the one which he gets in his ordinary forestry training.

The professional education of the

average forester gives him a definite attitude toward the forest. He treats it as an area of woodland, composed of stands or groups of trees and shrubs. He gets more or less of an idea of the ecological relations of these, but the emphasis is placed almost entirely on the vegetation. The birds and animals associated with the woods are considered as tenants, some of whom are desirable, while others might as well be non-existant as far as their effect is concerned. Or perhaps they may be looked upon as squatters, whose presence is tolerated when it is not actually a menace. He studies the protection of the forest from its enemies: again entirely a vegetation viewpoint.

Now this attitude is in itself valuable. It is necessary for the forester to possess it. After all, his business is to grow trees and to protect them, and his main interest lies in them. But as a biologist he must consider the forest in a different light. He must see it as composed, not of trees and shrubs alone, but also of the animals, birds, fish, insects, and every other kind of life present. He must recognize it as a dynamic organism in itself, composed of innumerable parts, the inter-relations of which are of a profound significance in the well-being of the whole. The organism is not complete when any part is missing. Furthermore, this complex organism is not limited to the surface of the ground, but includes as well the air and the soil, with all their inhabitants.

It may prove helpful if we try to answer this question: Could the forest exist without animal life? It would doubtless be impossible to keep all forms of animals out of the forest, but if it could be done, would the forest continue? Probably it would get along very well without the mammals; one can imagine such a forest. But could it do without the birds, or the fish, or the snakes, frogs, lizards, and such forms? To many of us a forest in which there were no flies would be a synonym for Paradise. We know that insects aid in pollination, but many trees and plants are either wind pollinated or self pollinated, so there could be a forest without insects. Worms keep the soil in the best condition, but forests exist on soils too acid for worms to endure,—their presence is not absolutely essential. Besides these, however, there are to be considered the smaller organisms of the soil, the bacteria, and here we may pause. If we classify them as plants then possibly the forest could exist in the absence of animals. In the past some have considered them as a form of animal life. Whether they are truly plants or animals, the forest will not be able to get along without their aid. They are essential factors in the decomposition of dead plants, leaves, and wood, in the formation of organic matter and in the synthesis of available forms of nitrogen, and without these the forest would cease to be.

Although the question cannot definitely be answered, the consideration of its possibilities, with those of its converse, should bring one to the point of view in which the forest takes on the aspect of a complex organism. The next step is the idea that the forest is not static, that it is dynamic. The ages, sizes, and numbers of its component parts must always be changing, therefore their inter-relations must change, and consequently the forest itself is in a state of constant change. And this perpetual variation, over the whole organism, tends to approach an equilibrium which it cannot ever quite reach, because of its own tendency to be forever changing. This, then, is the so-called Balance of Nature, present in every piece of woodland today, whatever the conditions. Although it has been loudly mourned by many as a thing past and done with forever, it still exists and it will continue to exist. There is always a balance of nature, because there never was a *true* balance of nature. Such a situation is impossible. A true equilibrium, reached and maintained, would imply, for example, that a definite number of individuals of each species, *and no more,* must be produced annually; of these a certain fixed percent must serve as food for one enemy, another definite number must go to feed a second enemy, and so on. This is obviously ridiculous.

Instead of this hypothetical exact equilibrium, we know that in any region changes in the numbers of a species must occur, and must occur continually. Let us consider an example of three phases, omitting all other factors for the sake of clearness. Suppose that for a series of years the weather conditions during the spring were such that a much larger number of Ruffed Grouse chicks were able to survive than would ordinarily do so. This would result in a great increase in the Grouse population of that region; the change would be upward, away from the average numbers. Following this increase of Grouse would be a corresponding decrease in the amount of grouse food present, since each year there would be a greater number of birds to consume it. If this condition continued, a time would come when the food would be so nearly gone that many of the Grouse would starve, and a reduction of the population would set in; the change would be back towards the average. Or, if there were ample amounts of food present, such an abundance of Grouse would mean better hunting for the Foxes and more of them would survive the lean periods, which would mean more Foxes to hunt and more Grouse killed each year; again the change would be toward the average. Then the relation between the Foxes and the Grouse would follow the same path as that of the Grouse and their food. In any case, the numbers of Grouse would swing back and forth past the average point, and these oscillations would be accompanied by similar and opposite oscillations in the numbers of their enemies and of their food species. In other words, the so-called balance of nature is an intricate mass of rising and falling populations. In its state of constant flux, the food relation is probably the most important single factor in the life of any animal or race of animals.

In the second-growth woodlands of today these oscillations occur in the same manner as in the primeval forests. There is this difference: that through the interference of man, a large number of species have been removed which would have acted as checks upon or as food for the species left. Hence the fluctuations in these remaining species must occur between much wider limits than would be the case in the primeval forest. Man initiates such an oscillation when he plants a pure stand of White Pine, for example, or stocks a forest with an oversupply of Hares. In the first case the restraining oscillation might be an immense increase in the number of weevils, or of fungi, which would eventually reduce the Pines to a number far below the equilibrium. In the case of the Hares, if man had carefully trapped out their worst predatory enemies, then the food supply might very well serve to reduce their numbers, or disease would spread more easily and rapidly among them.

Thus, emphasis placed upon any part of the forest organism tends to cause wide oscillations. Outbreaks, infestations, blights, and plagues are all examples of this law. The emphasis may be on timber production, or the creation of parks, or it may be on game preserves, or on game farms. There are numerous other examples but these will serve. Each one of them emphasizes a different part of the original organism, and as a result each has a different class of natural enemies against which it must be protected. The balance of nature is present in each case, but it is only the widest oscillations which force themselves on our notice. Protection and production themselves fluctuate.

Recognizing that these changes must and will occur in any managed area, the problem is one of control of the disturbed relations. Natural control, as we have seen, would be by means of opposing changes, but in many cases this would require a long period of time which man cannot always afford. Nor could it usually be permitted in view of the object of management. Artificial control is carried on in various ways:—cultivation, spraying, thinning, planting, trapping of vermin, planting food species, etc., depending on the location of the emphasis of production. In a state of nature complete extinction of any species would not ordinarily occur, and it would probably be economically prohibitive to attempt it artificially. Then the objective of control of any enemy should be to reduce the limits of its oscillations, to hold it in check rather than to exterminate it.

To return to the subject, it was pointed out that successful forestry is a combination of economics and silviculture. Economics must, of course, be applied to the cultivation of wild life as well as to that of wild trees. Silviculture is based on plant ecology. If the forester is to become a biologist and control the fish and game, it will be necessary to have some knowledge of animal ecology. He must know the relation of each animal to its environment.

Assuming that he is acquainted with the laws of economics, that he understands the fundamental principles of silviculture, and that he agrees with our conception of a forest and of the balance of nature, what are the problems he will have to solve in incorporating animal life into his plan of management, and what knowledge will he need for their solution?

PROBLEM I. To determine the population of the forest.

In any productive business it is necessary to know how much stock is on hand,—an inventory must be taken. The forester calls this making an estimate of the standing timber, dividing his area into smaller homogeneous parts to improve the accuracy of his estimate. The crudest example of this would be a division into hardwoods and softwoods,—into deciduous trees and evergreen trees. The first step, then, is to take an inventory or census of the wild life present in the forest,—to determine as closely as may be just how many Deer, Foxes, Hares, Grouse, and so on, are living there. Here the same idea of division into smaller parts is applicable, cutting up the forest area into the habitats recognized by ecologists. We may find, however, that the chosen haunts of any animal are apt to be those wherein it finds the sort of food it likes best, which places the emphasis on the food rather than on the habitat conditions. Furthermore, the extreme mobility of the various forms of life tends still further to reduce the importance of the habitat. Animals may be encountered almost everywhere outside their supposedly preferred haunts, while birds are especially prone to travel. Hence, it will probably be necessary for any sort of survey or census to include a wide strip around the forest area itself, if a really workable plan of management is to be evolved. The technique of making a rapid and reliable study of the number of animals and birds present in any area has not so far been worked out. Whatever system may be used, the forester will be required to identify the different species,—not only by examining the individual specimens, but also by their tracks and other signs of their presence. In addition, a knowledge of their homes,—nests, burrows or whatever, will be valuable, especially as regards the choice of habitat.

In many species, notably the birds and insects, there is a decided seasonal fluctuation in numbers, and spring is probably the best time to attempt a census of many of them, when the number of singing males is a good index figure. In the same way every species may have a certain period when it is easiest to determine the population. Obviously winter would be a poor time to count Chipmunks or Woodchucks, whereas it may prove to be the best season to check up on Foxes or Hares.

PROBLEM II. To classify the species as to their desirability.

A second consideration is that of the inter-relations of the birds and beasts among themselves, as well as to trees and other plants. What particular species are to be considered as harmful, and which ones are beneficial? Here, with some exceptions, the all-important factor is the food habits. The various stages of parasitism enter into the relations of animals, and at least a working knowledge of this phase is important. Examples are common, both in plants and animals. The most essential feature of it is that in most cases it is a food relation with which the forester is concerned.

As an example of a desirability classification, let us take the relations to the important forest trees. Then all the other forms of life may be grouped under four heads.

1. Actively beneficial. The life habits of the members of this group are such as to make their presence welcome. Certain kinds of Snakes, Woodpeckers, and Kalosoma Beetles are good examples.

2. Passively beneficial. This group, while fundamentally neutral, may serve as food for a species whose presence is desired. It would include Black Flies, Mosquitoes, and similar insects which do not harm the forest.

3. Passively harmful. Here would be grouped such vermin as Cats and some Hawks which prey on beneficial species, but which do not otherwise harm the forest.

4. Actively harmful. There are a great many kinds of insects and rodents which actually damage the trees, and these would be placed in this group.

The relations of a species may change during the life of the forest, with the season of the year, with the policy of the owner, or with the forest region. Deer sometimes cause damage to young trees, and otherwise beneficial birds must be kept out of the forest nursery for a short time in the spring. In one forest the Beaver is welcomed, in another it is a nuisance.

Having considered them from the standpoint of the vegetation, their relations with each other would be the next proposition, taking the birds as a group instead of the trees, then the mammals, and so on. At first thought this looks like a hopeless task, but in view of the fact that most of the actively beneficial or actively harmful species are commonly recognized as such, it will probably prove somewhat easier than it sounds.

PROBLEM III. To control the undesirable species.

PROBLEM IV. To propagate and protect the desirable species.

After classifying the animals and birds as to their desirability, the forester is confronted by two more problems. How to control or reduce the numbers of the undesirable species, and how to protect and increase the desirable ones. And the same factor is met with again,—if a species is to be introduced, propagated, protected, reduced or exterminated, its food is almost always the vital point of consideration. In many cases, the life history will point out an especially favorable season for control work. Insects are the outstanding example of this. In starting the program, it may be necessary to raise and release individuals of some species, so as to give them a good start. This sort of work requires a special knowledge, but it is one on which plenty of good handbooks are available, as well as advice from the U. S. Government.

PROBLEM V. To determine the normal population.

Then, too, it is essential to know just how many animals any given area of forest can maintain, in other words,—how much food is there present, and how much does it take to support a certain number of individuals? Unfortunately, qualitative knowledge of the food of animals is rather hard to acquire and quantitative information is extremely scarce. It is comparatively easy to find out the preferred habitat of a species, but when it comes to food, all sorts of statements are readily available, a great many of them contradictory. Very few are detailed, many are inaccurate, and almost none are scientifically presented. Birds have been the subjects of most of the really reliable studies, but the results of these are widely scattered and difficult to obtain. Furthermore, since they are built up from studies made all over the country, they may not be directly applicable to any specific locality.

In determining the normal population, the extent of the home range of the individual is very important, and may prove to be a limiting factor. Brewster has pointed out that, apparently through sexual jealousy, many male birds will not tolerate very near neighbors of their own species during the season of reproduction, though they seem quite willing to share their domain with birds of other and perhaps closely related species. In consequence, they are more or less evenly and generally distributed throughout their chosen habitat, but within it their numbers do not seem to increase beyond fixed maximum limits no matter how carefully the birds may be protected or how successful they may be in rearing their young. This same attitude is doubtless more widespread among mammals than we might suppose. Here, however, it is probably as a hunting ground rather than as a harem that the individual establishes his range. Trees bitten and scratched by bears to serve as "No Trespass" notices to others of their kind furnish a widely known example.

Then we should know the breeding habits of the species,—how fast do they increase annually? The average length of life enters into the question here, as well as the migratory habits of certain animals. In other words, we want to know how long they will live; at what age they will start to breed and how many years they will continue; how many young are produced annually; and how many of these young may be expected to remain in the immediate vicinity.

PROBLEM VI. To combine forestry and wild life production.

Here we may properly consider the question of the management of the forest as a whole. To make his woodlands produce the highest returns the forester must plan to raise a crop of trees as well as a crop of animals. In order to do this effectively, silvicultural operations will be necessary. These may include planting seeds, setting out seedlings, thinning dense stands of young trees, removing poor or worthless species, pruning limbs, cutting mature timber, and disposing of logging debris, as well as protecting the forest against fire and other enemies. Each one of these operations produces a change in the forest vegetation and must accordingly have a pronounced effect upon the fauna. Not only is it likely to change some of the climatic factors of the environment, but it may also affect the food supply, the opportunities for homes or nests, and the presence of natural enemies. So simple a process as removing the hardwoods from a stand of pines may result in a decided change in the numbers and species of birds present, while the complete effects of logging off all the marketable trees can hardly be estimated.

Here, then, is the most delicate task confronting the forest biologist. He must weigh the benefits of any operation against the harm it may do, and it will not usually be the immediate profits or losses which will influence his decisions. This is the point at which our concept of the complete forest organism and of the balance of nature will be of the most fundamental significance. Any successful blending of silviculture and wild life production calls for the highest sort of scientific knowledge and technical skill, such a combination as is extremely rare if, indeed, it exists at all.

PROBLEM VII. To dispose of the animals produced.

Having put his forest on a productive basis, controlled the predatory species, and protected the valuable ones, the time will come when the forester must gather the crop he has produced. Here, of course, the purpose for which the wild life has been handled will determine the procedure. The first part of this paper pointed out the various phases which such management may take. If the returns are to be anything other than aesthetic,—if the objective is better hunting, or the sale of meat, skins or live animals, there comes up for consideration the question of the annual crop, the allowable kill, or the bag limit, as it is variously expressed. Of course this depends on the breeding habits, and the rate of annual increase will determine the numbers to be taken each year.

In addition, the best methods of taking should be known, as well as the proper time of year in which to do it. State and Federal laws affect these in a great many cases, as we all know. Laws also control the sale of wild game and skins, in some states being prohibitive. A knowledge of the best market and the demands of that market, will also govern methods, and the forester should, of course, be acquainted with the prevailing prices.

This completes the list of problems of which the discussion is admittedly sketchy and incomplete. It attempts only to point out the major topics, each of which may well be the subject of many detailed investigations. If, in the course of it, I seem to have described a job which is impossible to carry out, my response is that just exactly such tasks are going to appear and they will not be so very long in coming. In fact, at some time or other, I have been asked or I myself have asked, practically every question brought out in this discussion. And I believe this is not at all an uncommon experience, because foresters everywhere are giving considerable thought to the task of handling wild life. At least one of them is to publish a handbook on this subject in the near future.

Possibly the best way to summarize this paper is to present in condensed form a list of the problems and their sub-headings.

Problem I. To determine the present population.

- Technique of taking a census.
- Identification of the various species.
- Tracks and signs.
- Habitat preferences.
- Homes.
- Seasonal habits.

Problem II. To classify the species as to their desirability.

- Qualitative food habits.
- Parasitism.

Problem III. To control the undesirable species.

- Qualitative food habits.
- Life history.

Problem IV. To propagate and protect the desirable species.

- Food preferences.
- Habitat preferences.
- Nesting or breeding habits.
- Natural enemies and their control,—see Problem III.

Problem V. To determine the normal population.

- Quantitative food habits.
- Home range of the individual.
- Breeding habits.
- Length of life.
- Migratory habits.

Problem VI. To combine forestry and wild life production.

- Effects of silvicultural operations.
- Methods of counteracting these.
- Significance of environmental factors.

Problem VII. To dispose of the animals produced.

- Annual increase, or allowable annual kill.
- State and Federal game laws.
- Best method of taking and preparing for market.
- Best market and methods of marketing.
- Prevailing prices.

This, then, is the summary of the type of knowledge required of the forester of the future. Equipped with such information he can take over the task of handling the wild life, and base his working plans on definite facts. Without it, there can be no successful management of the complete forest organism, in all that this implies.—*Presented before Phi Chapter of Phi Sigma, November* 30, 1927.

Read The Biologist

Mu Chapter of Phi Sigma

A Contribution by Members of the Chapter, Coordinated and Edited

By Marion Stilwell (Mu '28)

At present the center of interest on the campus at the University of California, and especially for the members of Mu Chapter of Phi Sigma, is the erection of the new Life Science Building. Almost every department which is to have its headquarters there is represented in Phi Sigma. Twelve wooden buildings which are veritable fire traps now house the departments of Biochemistry, Plant Nutrition, Museum of Vertebrate Zoology, Physiology, Pathology, Botany, Anatomy, Psychology, Zoology, and the Public Health Building. The botany laboratory is now merely an old residence fitted with tables and lockers.

The new building, to be built at a cost of $1,750,000 will have three acres of floor space and will be 450x 230 ft. There will be five stories and each department will have about 60% more room than at present, to say nothing of the many added conveniences.

A science library large enough to hold 90,000 volumes and an auditorium to seat 500 are some of the features. Each department will have its own refrigerating system so that if one unit is out of order the others will not be affected. The whole building will be equipped with running hot, cold, soft, and distilled water.

The following departments are those which are fortunate to be located in the new building and although working under present disadvantages they are nevertheless carrying on active research.

ANATOMY AND MEDICINE

By A. R. Curlin

Students of the departments of Anatomy and Medicine (first year class) are actively engaged in a number of special research problems:

ANATOMY:

Mrs. J. G. Dispensa—The Influence of the Anterior Hypophyseal Growth Hormone on the Course of Gestation in the Rat and the Time of Ovulation in the Rat.

Dr. Robert O. Moody—On the Normal Position of the Viscera in Healthy Adults.

Miss C. Kidder—Assisting Dr. Moody.

A. Pereyra—On the Function of Corpus Luteum Including Extraction and Injection of the Active Principle.

Mrs. Helen M. H. Fitch—1. Development of the Epiphysis in Squalis acanthias. 2. New Staining Methods for Muscle-tendon joints.

MEDICINE:

- *Mrs. M. E. Stoker*—The Regeneration of Blood in Anemic Rats.
- *W. B. Chew*—Epiphyseal Ossification in the Tibia and Fibula of the Rat.
- *E. Jackemy*—Observations on the Living White Cells of Human Blood With the Dark Field Microscope.
- *A. R. Currlin*—1. Development of the Vascular System in the California Newt, Triturus torosus. 2. Studies on the Spleen of the Rat After Intravascular Injections of a Mixture of India Ink and Janus Green.

BACTERIOLOGY

By Herbert Johnstone

Evelyn Lewis of the Bacteriology Department is now engaged in studies on the anatoxin of Botulinus.

Dr. A. J. Salle who took his degree in Biochemistry is at present Instructor in Bacteriology.

BIOCHEMISTRY

By Paul L. Kirk

That share of the new Life Science building which is to be allotted to the Department of Biochemistry will consist of four units, chiefly located on the second floor, and with a part on the fifth or top floor. In addition to an abundance of class and lecture rooms there will be sufficient laboratory space for about double the present amount of undergraduate and medical students. These laboratories will be of the most modern type, probably having among other innovations table tops of Bakalite. There will be individual laboratories and offices for full time staff members and five research laboratories for assistants, in addition to one large general research laboratory.

Special rooms will be used for refrigeration, incubation, balances and centrifuges, one of which will be specially equipped with electrical appliances suitable for use in continuing physical studies now being carried out, chiefly on proteins.

On the fifth floor colonies of all the common experimental animals will be kept. A novel feature of these rooms is the use of windows permeable to ultraviolet light. On this floor will be built in a series of special rooms with automatic climatic control. One will be of metal capable of withstanding a pressure of several atmospheres or a vacuum corresponding to about 30,000 feet altitude. One will contain a tropical climate, very hot and humid, and one will simulate the Arctic regions. These rooms will be used in testing the effects of climate on the metabolism of rats, a study which has already been under way for some years.

The following are some of the problems which are now under way:

- *Dr. L. C. Rawlins*—On the Nature of the Combination Between Certain Acid Dyes and Proteins.
- *Dr. D. M. Greenberg*—Physical Chemistry of Proteins, Particularly Their Transport Numbers. Also work on Calcium in the Blood.

BOTANY

By Irma Webber

Most of the Botany Department will be located on the main floor of the new building. The herbarium will have the stack system like the library and will occupy one large room on each of the five floors. There will be an elevator between them. Each branch of Botany will have its own laboratory and the research students will occupy large rooms divided into compartments. All special equipment needed will be furnished including constant temperature chambers and a greenhouse on the top floor. The latter will be separated by an air space from the building below to prevent fumes from the building reaching it.

Although at present the equipment of the department is poor there are a number of research problems in progress:

William Gray—1. Interspecific Hybridization in Nicotiana; some cytological and other features of F_1 glutinosa and sylvestris. 2. A Quantitative Study of the Effect of Radium Rays on the Germination of Seeds.

Irma Webber—1. Pleistocene Woods from Carpenteria, California. 2. Histology of Fossil Wood.

Florence Angwin—Style Branches of the Compositae.

Ferdinand Mehrlich—Rejuvenation in Bryophyllum.

Helen Monosmith—Sterility in Allium cepa.

Marion Stilwell—Studies on the Relation Between Transpiration and Absorbing Surfaces.

Ruth Wall—Life Histories of Some Pleosporas (Fungi Imperfecti).

Helen Mar Wheeler—A comparison of Nicotiana tobacum with 2n+1 and 2n+2 Chromosomes.

PLANT NUTRITION

By J. L. Doughty

The present premises of this department are some rambling wooden buildings. In the new grounds there will be several notable features including a Nitella pool. This plant has such large cells that it is one much used in plant nutrition studies.

Three members of Phi Sigma who are now engaged in plant nutrition investigations are:

Dr. A. R. Davis—The Growth of Plants Under Controlled Conditions. The factors of light, temperature, and humidity are kept under control.

T. C. Dunne—Buffer Systems of Plants.

J. L. Doughty—Relationship of Organic and Inorganic Phosphorous Compounds in Soils.

PSYCHOLOGY

By Merle Elliot

The plans for the Psychology Department in the new Life Science building provide adequate space for animal experimentation, including a large vivarium and a number of rooms for research workers.

Mr. Robert C. Tryon has been granted a National Research Council Fellowship for the year 1928-29.

The research now going on may be summarized:

Robert Tryon—1. The Inheritance of Maze Learning Ability in Rats. This involves an attempt to segregate strains of animals which will breed true in regard to various levels of ability and an attempt at the manner of inheritance. 2. Correlation between mental ability and various physical traits.

Merle Elliot—1. The Relationship between the Internal Physiological Condition of Animals and Their Learning Ability. 2. Determination of the Sense Modes Utilized by Rats at Various Stages of the Learning Process.

VERTEBRATE ZOOLOGY

By Herbert Johnstone

The research interests of Dr. Joseph Grinnell, Director of the Museum of Vertebrate Zoology and Professor of Zoology, lie in the field of systematic and faunistic vertebrate zoology. He studies *species,* each in its natural environment, and tries to determine the conditions of existence for each. He assembles data and formulates theories having to do with the process of species formation through both space and time; and he is now inclined to think that the course of vertebrate evolution has been directed and controlled largely by changes in, and the evolution of, environments.

ZOOLOGY

By Herbert Johnstone

The Zoology Department, like the Botany, in the new building will have the laboratories situated in the wings which project into the center court around which the building is erected. Each laboratory will be divided by a glass partition into two divisions large enough to hold about 24 students—a suitable number to be handled by a teaching fellow. There will be space on top of the building to house the animals used in experiments. Although the pools in the center of the court have not yet been assigned definitely it is probable that this department will have one.

The Zoology Department is a large one and has many workers engaged in active research:

Hildegarde Howard—The Avifauna of Emeryville Shellmound. This involves comparative osteology for identification of species, comparison of Emeryville avifauna with that of the present bay region, and with that of the Pleistocene.

Mary Frances Sanford—The Arteries of the Albino Rat Embryo at the Fourteenth Day of Development.

Elizabeth Lewis—Endamoeba dysenteriae as Found in the Walls of the Human Intestine with Special Reference to Distribution.

Margaret Schell—Study of Incidence and Significance of Intestinal Protozoan Infections in School Children and Those of Pre-School Age.

Elizabeth H. Custer (Lambda Chapter, Montana)—1. Culture and Experimental Infections of Cats with Endamoeba dysenteriae. 2. Effects of Radium on Endamoeba dysenteriae in vitro.

Owen Williams (Xi Chapter, Nebraska)—Nematodes of the genus Acuria Bremser. A redescription of the type species from material from the museums of Vienna and Berlin to be compared with new species obtained from North American birds.

Dora Henry—Investigation of Eimeria avium of the Common Chicken.

Ena A. Allen—Culture Studies of Councilmania dissimilis Kofoid.

Herbert Johnstone—The Protozoan Fauna of the Human Mouth, the Dog Mouth, and the Monkey Mouth. The Stomatological Group on Pyorrhea alveolaris.

Virginia Condit—Breeding Experiments with a Species of Carp, Cyprinidae, with the Idea of Attempting to Influence the Sex Ratio.

W. H. Burt (Kappa Chapter, Kansas)—Morphology of the Woodpeckers; their Pterylography, Myology, and Osteology—especially of the North American forms.

J. M. Linsdale (Kappa Chapter, Kansas)—Skeletal Variations in the Fox Sparrow, Passerella iliaca, with an Account of the Natural History of the Species.

Dr. Samuel Gelfan—The Electrical Conductivity of Protoplasm.

Richard Pencharz—Experiments Concerning Ovarian Regeneration in the White Rat and White Mouse.

The following publications from this department have been cited for this year:

Dixon, Joseph—Fur Bearing Mammals of California (with Dr. J. Grinnell)

————Birds and Mammals of Mt. McKinley National Park (with George M. Wright).

————Deer Grazing Problems in California (with Dr. A. W. Sampson).

Fisher, Edna—Mammals of the Emeryville Shellmound, with Special Reference to the Sea Otter—an Historical and Osteological Study.

————Variation Within a Brood of Pacific Garter Snakes—Univ. of Cal. Zool. 30:9:1928.

Howard, Hildegarde—A Review of the Fossil Bird, Parapavo Californicus Miller, from the Pleistocene Asphalt Beds of Rancho La Brea.—Univ. of Cal. Pub., Bull. Geol. Sci. 17:1:1927.

PALEONTOLOGY

By Nellie Tegland

Although the Paleontology Department is not one which will move into the new building it is an important one and has a number of members with research well under way.

Dr. B. L. Clark—1. Studies in Tectonics of the Coast Ranges. This is with special reference to the San Joaquin Valley and deals with primary faults and folding in the Coast Ranges. 2. Paleogeography of the Coast Ranges. With reference to the mapping of the successive seas of the Tertiary, and somewhat earlier epochs. 3. Geology of Mount Diablo. With reference to the stratigraphic viewpoint. 4. The Marine Oligocene of Alaska. A study of new species of the sandstones.

Dr. R. A. Chaney—Pleistocene Floras of Coastal California. The Sequoia element found here is interesting in determining the Pleistocene temperature conditions. 2. The Goshen Flora of Oregon of Older Tertiary Age. This shows connections with South America and Southern Asia.

W. H. Corey—Fauna and Stratigraphy of the Vaqueros Formation (Lower Miocene) of South Mountain and Oak Ridge, Ventura County, California. Living conditions show types of a warm water fauna with 25 species new to science. An interesting feature is the alternation of marine and land laid beds.

Edward D. Pressler—A contribution to the Paleontology of the Las Posas and Oak Ridge Districts, Ventura County, California. Close analysis of the faunas shows a marked temperature difference which would indicate a time difference between the upper Pico and Saugus beds.

Thomas J. Ethrington—Stratigraphy of a Portion of the Cheoalis River Valley, with Special Reference to the Marine Fauna of the Middle Miocene. This involves a comparison of the Middle Miocene Fauna with that of the same age in California. This will bring out facts concerning distribution of species and temperature conditions during that time.

Nellie M. Tegland—1. Thyasira disjuncta Gabb not Thyasira bisecta, the Recent West Coast Species. A rectification of a long standing error with reference to the two named species.—The Nautilus, April 1, 1928. 2. The Marine Molluscan Fauna of the Type Blakely, Upper Oligocene of Washington. This is a study to make known the species of this horizon which gives rise to such generic problems as: 3. Thyasira in the Tertiary of the West Coast. 4. Pitaria in the Oligocene of Washington, with description of a New Subgenus.

Dr. C. L. Camp—1. Faunas of the Triassic of Arizona. 2. The Phytosaurs of the Chinle. 3. The amphibians of the Chinle. 4. Smaller reptiles and fishes. 5. The embryonic skull of the Alligator.

PHI SIGMA AND THE COLLEGE OF AGRICULTURE

By Walter Lammerts

Beside the above departments which are being taken care of by the Life Science unit there are several departments which, though just as truly biological are interested in problems of a more directly practical bearing. These departments, namely: Plant Pathology, Sub-tropical Horticulture, Forestry, Entomology, and Genetics are in the College of Agriculture and under its administration. The College of Agriculture of the University of California has many ramifications. Thus research is divided between the Citrus Experiment Station at Riverside, University Farm School at Davis, and the Berkeley Station, with several smaller local stations such as the Rice Investigation Station at Biggs. All the academic work however is carried on at Berkeley.

Since the erection of the new greenhouse unit, research at Berkeley has gone on much more rapidly. The greenhouse unit consists of ten greenhouses and five head houses. Temperature control in these has been perfected, heat being furnished by the University engineering unit. The various departments each have a portion of the greenhouse space.

PLANT PATHOLOGY

By Clara Bishop

Professor R. E. Smith is in charge of the general research and control measures including study of resistant varieties. One of the very important problems in this state is the control of walnut blight. Though numerous attempts to control this disease by spraying have failed in the past, it now seems that a spraying program has been worked out which gives control. Work so far indicates that repeated spraying at time of leaf unfolding is a satisfactory check.

Professor W. T. Horne is working on a cherry disease known as the "Cherry Buckskin" disease which is due to an unknown cause, but probably of a virus nature. He is also working on diseases of citrus and subtropical fruits.

Dr. T. E. Rawlins is interested in the cause of the celery trouble which as yet has no name. It is probably a virus disease. He is helping Professor Horne investigate the "Cherry Buckskin" disease, and working on the Mycorhizas of celery.

Mr. J. E. Thomas as former president of Mu Chapter has for his problem studies on the nature of parasitism of Armillaria mellea and the resistance exhibited by different hosts.

Mr. M. C. Goldsworthy is working on bacterial gummosis and sour sap of fruit trees. He has also been doing work on the peach rust. His research is particularly interesting in that he has been using seriological methods in the study of the organism.

Mr. H. N. Hansen for some time has been interested in the control of endosepsis (internal rot) of the fruit of the fig, and is also working on the "pink root" of the onion caused by a species of Phoma. He has worked out an ingenious method of controlling the fig disease by sterilizing the wasp which not only aids in caprification but also carries the fusarium fungus causing the endosepsis. He is in charge of the campaign to eradicate the disease throughout the state.

Miss Clara Bishop is engaged in further studies on Melaxuma of the walnut which include investigations of favorable conditions for growth and histological study of the fungus in walnut tissue.

SUBTROPICAL HORTICULTURE

By Hermanus Van Elden

The scientific research problems under investigation in Subtropical Horticulture are practically all conducted at Riverside (Citrus Experiment Station) and only a few problems, whose nature is such that they can be carried with the facilities available, are undertaken at Berkeley. Professor R. W. Hodgson is in charge of the work and is a member of Phi Sigma. The problems are:

The climatic distribution of the genus Citrus in the western states. A statistical study to determine the exact geographical distribution of citrus trees with regard to such factors as temperature, humidity, etc.

A study of the starch cycle in certain deciduous and evergreen subtropical fruit trees. This problem is strictly microchemical, the observations being made at definite intervals extending over a period of four months, January to May.

Mr. Van Elden is working on a cytological investigation of the fig (Ficus carica) and the avocado (Persea americana) and the closely related species of these two subtropical fruits. So far the chromosome count has been determined.

An investigation of the annual cycle of nitrogen in the young citrus trees is being carried on. This attempts a study of the distribution of total nitrogen in the young citrus trees at various times throughout the year and similarly for the principal inorganic constituents. (Macrochemical).

FORESTRY

By Donald Sinclair

During recent years the Forestry Department has grown by leaps and bounds until now almost 50% of the agricultural student enrollment is in the School of Forestry. Last fall it was decided by the local chapter to incorporate this very important division of biological activity into the ranks of Phi Sigma. Accordingly a group of the most prominent and active graduate and undergraduate students were taken into the society. This spring we are endeavoring to make the Forestry faculty membership 100%. Professor Walter Mulford is head of the school and is being initiated as a faculty member.

The research activities are of course varied and have become more so since the establishment of the U. S. Forestry Experiment Station with offices at Hilgard Hall. The following activities will give some idea of work in this department:

Mr. R. W. Cowlin has as the title for his master's thesis, "The Wholesale Middleman in the Lumber Industry". He has had five years experience in the manufacturing, wholesale, and retail lumber industry and is at present doing graduate work as Bidwell research assistant in forestry.

Mr. Donald Sinclair is now carrying on research work in plant ecology by growing several of the most important grasses of the California foothills in potometers filled with fertile and infertile soils. The purpose is to correlate plant succession with soil depletion and other ecological factors.

Mr. R. B. St. John is working with Dr. Sampson on plant distribution in relation to climate. He expects to do field work this summer in the Sierra Nevadas on plant indicators of forest and grazing types of vegetation.

Mr. E. G. Wilson's thesis is "The Stem Form of Douglas Fir". This is a study of the factors which tend to influence the shape of the tree.

Mr. Waldo E. Wood is working on a management plan for a stock ranch in the foothills near Mt. Diablo. He is trying to correlate the growth of several important herbaceous species with soil and climate conditions in view of adjusting the present management plan on this ranch.

Mr. Ernest Wright since graduation has been with the Forest Service in Oregon and with the Bureau of Plant Industry in California. He is now the Baker research assistant in Forestry and is studying the tolerance of native seeds to high temperatures.

Mr. W. C. Lowdermilk is engaged in a study of the factors affecting superficial run-off which attempts to answer the question of what becomes of the rain with particular reference to its absorption by the land surface. Studies of this nature were conducted quantitatively for the past three years in China with instruments of the writer's design whereby the tipping bucket principle is used both for the rain and for the run-off gages.

ENTOMOLOGY

By Donald DeLeon

The Entomology Department is a very large and active one. Work is divided between Davis Farm School, Riverside Citrus Experiment Station, Berkeley, and San Jose Experiment Station. At Davis a new Animal Science Building is being erected which will be furnished with laboratory equipment for entomological research, making it second to none in the United

States as regards up-to-date facilities for study of the insect in relation to the environment.

The Entomology Department at Berkeley has one complete greenhouse and headhouse at its disposal. Investigation of the curly top disease of the sugar beet carried by the leafhopper Eutettix tenella Baker, is being actively pushed forward from all possible methods of approach.

Charles Henderson under the direction of Dr. H. P. Severin is now publishing, after his return from Argentina, in the U. S. D. A. series a report of his past year's work on the leafhopper.

Professor W. B. Herms is continuing his experimental and ecological studies of the Anopheles mosquito.

Dr. E. C. Van Dyke has completed two papers for publication: 1. A revision of the tribe Meloini, of the tribe Meloidae (Coleoptera). To be published by the University. 2. Descriptions of new species of Elateridae with a revised synopsis of many of the genera.

Professor E. O. Essig is working on a History of Entomology in California.

Professor C. W. Woodworth has completed a study of cyanide fumigation of Citrus insects. He is also working on a butterfly book.

W. W. Jones is studying the biology of Western Leaf-mining insects.

F. H. Wymore, along with a study of the life history of Western Cicadas is carrying on work on the Cucumber beetle.

J. F. Lamiman is working on the biology and control of the Red spider.

Leslie Smith has been studying the insects affecting raspberry, with especial emphasis on the Snowy Tree cricket.

R. W. Burgess is studying the biology of the Clear Lake gnat and methods of control. This gnat has only been found in Clear Lake, California, so far. He is also working on the vegetable weevil which is doing much damage around San Jose.

J. Tyler is studying the biology of the root-knot nematodes.

A. Downing is working on the larvae of Anopheles moculipennis; this is one of the malaria bearing mosquitoes in California.

R. E. Barrett is completing a study of the Coleoptera inhabiting the nest of the wood rat (Neotoma fuscipes) as well as studying the life history of the Black Widow spider.

D. A. DeLeon is studying, from a chemical view-point, the reasons for certain Bark-beetles selecting for attack slower growing Yellow Pine trees.

GENETICS

By Priscilla Avery

The very close relation between cytology and genetics is not lost sight of in this department as may be seen from the following research projects:

Professor E. B. Babcock is investigating the genetics, cytology, and taxonomy of the genus Crepis with attempt at a reclassification of the genus using genetic and cytological evidence as a guide to relationships.

Dr. R. E. Clausen is working on the effects of X-rays upon Drosophila hydei. He is also doing extensive studies, both cytological and genetic on species of Nicotiana and their hybrids.

Walter Lammerts is engaged in a cytological investigation of a sterile F_1 hybrid between Nicoliana and N. glutinosa, especially the distribution of chromosomes at the meiotic division. He is also studying both pollen mother cells and root tips of constant forms obtained by backcrossing the F_1 hybrid between N. rustica and N. paniculata to both parents.

Mr. G. F. F. Buckley is studying the genetics of barley with special reference to the inheritance of color of caryopsis and linkage relations.

Miss Lillian Hollingshead is studying the genetic and cytological situation in the F_1 hybrid between Crepis tectorum and C. capillaris, including a genetic analysis of a lethal factor of C. tectorum operating in species crosses, and a morphological study of the chromosomes of the parents and of the F_1 hybrid.

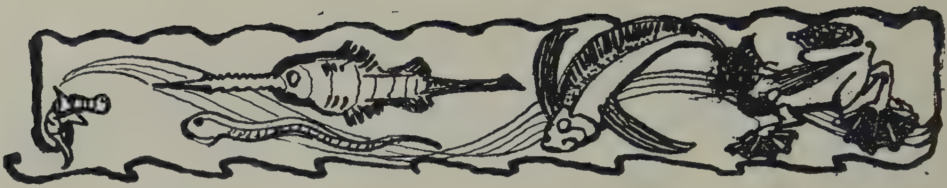
Miss Priscilla Avery is investigating the taxonomic and chromosomal relationship between Crepis leontodontoides and five other Crepis species belonging to two different sections of the genus.

Dr. J. L. Collins is applying genetic methods to the problem of the origin of species. In particular he is attempting to discover how different species of a single genus (Crepis) come to have different chromosome numbers. The general method employed is to cross existing species and produce in the progeny new morphological forms with the chromosome numbers different from the parental species and which will have all the requisites of a good species. Results have been obtained which indicate that new species can be produced in this way. The employment of such methods also give experimental evidence of the genetic relations of existing species.

At the last meeting of the society 35 new members were initiated, including Dr. W. D. Matthew, Head of the Department of Paleontology and Director of the Museum of Paleontology, as honorary member. Until last year Dr. Matthew was Curator at the American Museum of Natural History, New York. He gave the lecture of the evening on "Dinosaurs". The evidence of the different types of Dinosaur life was very graphically illustrated by slides. He stressed the fact that as yet the mystery of the sudden disappearance of the Dinosaurs was unexplained.

The officers for next year were elected: President, Alden Crafts; Vice-president, Marion Stilwell; Secretary, Clara Bishop; and Treasurer, Raymond St. John. They will have a society of more than 100 members to carry on the work next year. The retiring officers are: President, Walter Lammerts; Vice-president, Helen Mar Wheeler; Secretary, Lillian Hollingshead; Assistant, Esther Perry; Treasurer, Ruth Wall.

Read The Biologist



Phi Chapter of Phi Sigma

A Contribution by Members of the Chapter, Coordinated and Edited

By Dorothy T. Smith (Phi '26)

Historical Sketch of Phi Chapter

On December 8, 1916, a group of nineteen advanced Zoology students, feeling the need of closer association of interests, formed an honorary biological fraternity which was known as Pi Gamma. This organization was founded upon the principles of "scientific research and discussion".

Meetings were held every two weeks. They consisted of a business meeting, followed by a discussion of some scientific subject or the report of research work. Each year, a noted scientist was the guest of Pi Gamma in order that the members might have wider knowledge and a keener interest in research.

Out-door events were an enjoyable phase of the society's program. Field trips and hikes gave the students an opportunity to collect laboratory specimens and to make ecological studies of animal life. In 1921, trips to the White Mountains were inaugurated, the week-end being devoted to climbing and collection of material for research work. A Field Day was established in the spring, which was held on the sea-shore. This gave opportunity for study and collection of sea fauna.

In order to promote high scholarship in Biology, Pi Gamma offered a prize of twenty-five dollars, to be awarded at Commencement each year to the Senior who ranked highest in biological subjects throughout the entire four years of collegiate work. The amount of work carried in Biology, together with the average grade in all subjects were considered in making this award.

The purpose for which Pi Gamma was organized was gradually developed, due principally to the untiring efforts of the members to incorporate the ideals and spirit of the organization to those who followed.

In 1925, Delta Chapter of Phi Sigma Society of the University of Maine, feeling the closely allied interests of the organizations, invited Pi Gamma to send a representative to its initiation and banquet. Delta Chapter assured us that affiliation with Phi Sigma would necessitate no radical changes but would give us the added benefit of cooperation and stimulation with other chapters interested in research. Therefore, Pi Gamma petitioned Phi Sigma for affiliation which was granted April 25, 1926. Dr. Carl Wilson of Dartmouth College installed Phi Chapter on May 21, 1926. As Phi Chapter, our activities have been increased, each initiate has been required to present some original line of investigation and to support and maintain the ideals and true spirit of Phi Sigma.

The University of New Hampshire

Phi Chapter is located at the University of New Hampshire which is beautifully situated in the old and historical town of Durham at the head of Oyster River, fourteen miles due west of Portsmouth and the open sea. Situated at the head of the tidewater, it formerly served as a distributing center for the interior of the state. Thus the town of Durham is admirably located for the study of aquatic Biology.

The New Hampshire College of Agriculture and the Mechanic Arts was first created in 1866 and was established at Hanover in connection with Dartmouth College. In 1893, the college was first moved to Durham. It was only in 1923, that the University of New Hampshire was created by an act of the Legislature.

The University of New Hampshire is organized into three distinct colleges, the College of Technology in which no biological work is offered and in which the enrollment at this time is 371 students; the College of Agriculture in which are located a number of theoretical and applied biological sciences such as Agricultural and Biological Chemistry, Agronomy, Animal Husbandry, Botany, Dairy Husbandry, Entomology, Forestry, Horticulture, and Poultry Husbandry; the total enrollment now being 118 students; the College of Liberal Arts in which Zoology and Psychology are the only recognized biological departments. The enrollment at this time in this college is 1114 students.

Agricultural and Biological Chemistry

This Department was originally connected with the experiment station, doing only routine analyses and station projects. In 1920, a separate division was formed with H. R. Kraybill as head. Agricultural Chemistry which had been formerly taught by the Department of Chemistry was now transferred to this new department, and independent research work encouraged. In 1927, the department was reorganized under the name of Agricultural and Biological Chemistry, it being felt that the new name was more descriptive of the actual work and purposes of the department.

Dr. T. G. Phillips heads the department at present. His main interest lies in the field of Plant Physiology as related to Chemistry. He has published numerous papers on the nitrogen metabolism of plants and is conducting work on the metabolism of the apple tree with special reference to Horticulture.

The department has excellent facilities for research, including a very complete departmental library.

The Agronomy Department

The Agronomy Department is located in the west end of the agricultural building, Morrill Hall, and is associated with the Experiment Station. The department is headed by F. W. Taylor, Dean of the College of Agriculture. Dean Taylor, besides handling the administration duties and teaching several courses in Agronomy, finds time to conduct work in research.

Ford S. Prince, who has recently returned from Ohio and who was formerly an instructor in the department, acts as associate agronomist. He confines his duties to extension and research work alone. Leroy J. Higgins, a member of Phi Sigma, is at present the instructor in soils and crops. A new member, Paul Blood, will assume duties April first as assistant to Mr. Prince in research and extension. Miss Betty Glidden at present is serving as seed analyst.

The department is equipped with laboratories and equipment to carry out the various projects. The facilities are somewhat crowded to date but with the construction of the new college greenhouse next spring, more room will be added. Besides experimental plots at the University, there are three other locations of plots in different parts of the state where projects can be conducted under the same conditions as found in those sections.

Botany

The staff of the Department of Botany consists of five members, headed by Dr. O. R. Butler whose research work has dealt chiefly with the potato.

The Department of Botany is looking forward to considerable expansion at the close of this year when they will occupy all the space in Nesmith Hall. The Department is well equipped with electrical microtomes, autoclaves, sterilizers, refrigerators, compound microscopes, and a green house exclusively devoted to their work.

Entomology

The Department of Entomology is under the direction of Professor Walter C. O'Kane, an entomologist of national repute. The equipment aside from that usual for such work includes a large glass enclosed insectory, constant temperature chambers, and a large and very complete collection of the insects of New Hampshire. The work in Entomology is connected with the College of Agriculture, the Experiment Station, and with the State Department of Agriculture. Professor O'Kane is also State Entomologist. Research work is encouraged along the lines of Economic Entomology and Crop Pest Control.

Forestry

The Forestry Department is a part of the College of Agriculture. The students in this college have Freshman requirements with the other Agricultural departments, but they may specialize thereafter. Most of the forestry classes are also open to students registered in the Liberal Arts and Engineering Colleges. Professor Karl W. Woodward has been head of the department since 1915, and has built up a course which compares favorably with that offered in any of the undergraduate forest schools.

The University has about 200 acres of forest land, practically all of it being within twenty minutes walk from the Campus. The outstanding feature is a 50-acre tract of White Pine and Hemlock, 180 to 200 years old. This is managed as a park area, and serves for purposes of instruction in Forestry and Botany. It is easily within a quarter of a mile of the classroom, and very few, if any, of the eastern forest schools have a woodlot so old or so accessible. The rest of the University forest is second-growth Hardwoods and white Pine. Several age classes are represented, offering fine facilities for silvicultural purposes. All the work is carried on by students, and the young trees are planted only on the University property.

The foresters spend six weeks during the summer of their Junior year in camp in the north woods, where they make an intensive study of the Spruce and Hardwoods type of forest. Senior foresters are required to take a thesis course, and herein lies most of the research work done in the department. Investigations are carried on in the fields of Ecology, Silviculture, Logging, Wood-using Industries, Forest Management, and Mensuration.

Geology Department

The Geology Department has just moved to new quarters. The work in Geology has recently been expanded, both in number of courses given and in number of students enrolled. As the region around Durham is one of igneous and metamorphic bed rock, no great emphasis can be placed on the study of fossils. However, many tide flats and a small area of recently uplifted unconsolidated sediments are close at hand, and these are used to illustrate processes of fossilization and preservation of life forms. The region has been severely glaciated, hence this feature may be visually presented.

Inasmuch as the Department is very young, the collection leaves much to be desired in many respects. However, the Hitchcock Collection of thousands of specimens is in the museum. This collection of all of the rocks and minerals of New Hampshire was made in 1870-76, by the famous geologist, C. H. Hitchcock, and used as the basis of his three volume report on the "Geology of New Hampshire". The museum also contains the Walker Collection, consisting chiefly of Texas fossils, minerals, and rocks. Material is being rapidly added by the present staff members and students in Geology from local sources and from areas in the Appalachian Plateau.

The major emphasis in the Geology courses is cultural, as only a few students at New Hampshire as yet have made Geology their life work. "The greatest good for the greatest number" seems to indicate the presenting of the processes in the formation of the earth on which the student lives, the history of this earth, and the relationship existing between certain geological events and the development of life forms. Viewed in this broad light, the Geology Department at New Hampshire allies itself with Phi Sigma, the biological fraternity.

Horticulture

The Department of Horticulture is equipped to carry out research work on several important problems. Besides the research, there is a considerable amount of teaching in both graduate and undergraduate work carried on by the staff. At present there are six men on the staff, including two graduate assistants.

The teaching schedule consists in graduate and undergraduate courses. Considerable importance is placed on the graduate curriculum. Besides their problems, graduate students are offered courses acquainting them with literature and research methods in horticulture.

The Nutrition Laboratory of the Carnegie Institute

An experimental laboratory connected with the Carnegie Institute is located at Durham under the direction of Professor Ritzman. Special investigations during the past few years have been in connection with basal metabolism. This laboratory is one of the best equipped in the country for this work.

Poultry Husbandry

The activities of the Poultry Department of the University of New Hampshire are divided into teaching, extension, and experiment station work. However, there are no definite divisions in the staff doing this work with the exception of special emphasis being placed on each of these phases by certain individuals.

Since the time Professor A. W. Richardson took charge, some eleven years ago, the department as well as the poultry industry of the state, has increased tremendously. During the past three years, a poultry pathology laboratory has been added to the equipment, and the assistance of Dr. E. M. Gildow, Assistant Professor of Poultry Husbandry, and Dr. Walter Wisnicky, Pathologist, to carry on the disease program for the poultrymen of the state have been made available. Mr. H. O. Stuart has recently been procured from the University of Kansas as assistant in teaching and extension work.

The policy of the teaching staff has been to develop commercial poultrymen of the students presenting themselves for work. This has been the primary object of the instruction work, since the individuals taking this work are farm boys who expect to go back to the farm after completing their college work.

The extension phase of the work consists in the maintenance of a commercial flock of 1,500 laying hens at the University poultry plant. All of the equipment, buildings, feed and care of these birds is paid for by the birds themselves; in other words, this plant is a self supporting institution, and serves as an example of the poultry industry of the state.

Mr. F. L. McGettigan, the poultry extension specialist, carries on the regular extension work with poultrymen in the field; maintains a home egg laying contest for the poultrymen of the state.

All senior students majoring in poultry husbandry are required to take three quarters work in a course designed as "poultry research" in which the student is allowed to choose some problem that he can work out in that time.

Since the disease problems in poultry seem to be paramount in New Hampshire, research has been directed along these lines. Considerable work has been done upon paralysis or range paralysis of pullets, especially in regard to its association with coccidiosis of poultry. An attempt to adapt the new rapid agglutination test method to the baccillary white diarrhea eradication program is being attempted.

Experiments with the use of unattenuated chicken pox virus and production of immunity in birds has proved to be of considerable value and is being tried in the field.

A splendid opportunity to obtain training in regard to poultry management, and a keen appreciation of the need of further experimental work, is available at the poultry department. Considerable new equipment and growth in personnel is expected in the near future.

Psychology

The Department of Psychology at the University of New Hampshire is gradually expanding along the lines of experimental and comparative psychology. The department, which is still relatively small, is headed by Dr. Herbert F. Rudd, with Dr. Adolphe G. Ekdahl as Professor of experimental and comparative psychology. Under Dr. Ekdahl's directions, a class in comparative psychology is working on maze and puzzle box learning in white rats. This is the first work of this sort in psychology that has been undertaken at the University of New Hampshire.

Department of Zoology

The Department of Zoology is one of the largest departments on the campus, having a total enrollment of over 450 students, over a hundred of whom are majors. The Department is housed in Thompson Hall, which is a three story brick building. Professor C. F. Jackson has organized the Department into divisions of Anatomy, Embryology, Hygiene and Sanitation, and Physiology. Graduate assistantships are available for advanced students and the Department has a well organized graduate division.

This year, the Department has moved into enlarged quarters which materially increase its efficiency for research work. Three new laboratories are now available for undergraduate students. These have all been fitted with individual desks and individual locker space, making a total of 140 new desks. Two new advanced research laboratories have also been added to the department facilities. This affords adequate opportunity for graduate work in Embryology, Histology, Comparative Anatomy, and Physiology. These laboratories are well equipped with microtomes, paraffin oven, embryological incubators, glass topped individual desks, hot and cold water, dissecting and compound microscopes, an aquarium and vivarium. A stock room is maintained for supplies and the experimental rats are also kept here.

The proximity to salt and fresh water affords ample opportunity for research, as within a few minutes walk of the laboratory, Oyster River meets the tidewater from Great Bay. This furnishes a graduation of salt, brackish, and fresh water with an abundance of their characteristic fauna. Great Bay, the Piscataqua River and the open ocean are within easy access and furnish their own biological delights. A cabin cruiser and several row boats are accessible to those interested in the sea fauna. A complete camera outfit is also at the disposal of advanced students.

Within a few hours, the White Mountains can be reached and numerous investigations have been made in that vicinity.

The Biological Station

The Department of Zoology, University of New Hampshire takes pleasure in announcing the opening this summer of a marine Zoological laboratory and Summer Camp on the Isles of Shoals. These islands are located some ten miles off Portsmouth Harbor. Surrounded by the broad Atlantic, they form an excellent base for the study of marine fauna, presenting every conceivable condition from small, enclosed bays; sheer rocky bluffs; to depths of 200 feet or more. This is an entirely new field for Zoological investigation and a group of advanced and undergraduate students are looking forward with great enthusiasm to a summer spent under these conditions.

Full credit may be received for either graduate or undergraduate work. In addition to research work, regular courses will be offered in Ecology, Systematic Zoology, Comparative Anatomy, and Embryology. It is hoped that some students from other institutions may find it convenient to attend, since this adds greatly to the zest and value of Summer School work.

It is planned to keep the expenses down to the minimum for the student in attendance. For those who live at the laboratory, there will be no room charges, although the students will be expected to furnish a folding cot and bedding. Meals at the laboratory will be on the cooperative plan and limited to actual cost of material. For those desiring better facilities, board and lodging may be secured at the Star Island Hotel which is located on an adjacent island. The regular tuition fee of the Summer School of the University of New Hampshire will be charged. This depends on the amount of work taken, the maximum being $35.00. This would represent registration for a maximum of seven semester hours, provided the entire time is spent on Zoological investigation. The laboratory will open June 25 and close August 3.

Phi chapter of Phi Sigma extends a cordial invitation to all graduate and undergraduate members who are interested in a study of Zoology. The expenses of six weeks study will be much less than at the usual summer school session of biological laboratories.

Research in Phi Chapter

The real purpose of Phi Chapter is to further research in the biological sciences and while we have not the facilities that are offered by some of the larger institutions, every effort is made to interest students in research. Phi Chapter requires that a thesis be presented by each new member of Phi Sigma and that this represent the product of his own research.

Each term, five of the highest ranking students in Zoology are designated as Honor Students and are freed from all class work and encouraged to study a research problem in which they are especially interested. This is a great incentive to the students and causes friendly competition. At the end of the term, these students are given a comprehensive oral examination by the head of the department. The list this term comprises all Phi Chapter members, Anna Philbrook, Margaret Torrey, Joseph Houser, Cavett Prickett, Robert Garner, and Evelyn Davis, respectively.

Each staff member and graduate is at work on his own particular problem. Donald Barton, instructor in Zoology is in charge of the development of research in Phi Chapter and has stimulated much interest among the members.

Professor C. F. Jackson has made a collection of the mammals and fish of the state of New Hampshire. He is, also, interested in the effect of pollution upon animal life and has directed several investigations upon marine as well as fresh water fauna. During the Christmas vacation, Professor Jackson, and Donald Barton, made a study of the effect of the recent flood upon the mammalian life of Crawford Notch.

Professor Alma D. Jackson is working on the embryology of the Invertebrate Fauna of the Isles of Shoals.

Donald G. Barton is engaged in a study of the effect upon the offspring of prenatal feeding of anterior lobe pituitary on albino white rats.

Dr. L. P. Latimer is engaged in a study of the Physiological changes in apples fruits, especially with relation to changes in the electrical conductivity of the tissue during growth and storage of the fruit at different temperatures.

Dr. E. M. Gildow is devoting his time to preventing the spread of Bacillus white diarrhea in the chickens of the state. His work has been very efficient in checking this disease.

Prof. K. W. Woodward is engaged in diversified studies of White Pine development. Climate and Soil Factors of Forest Distribution and Forest history.

Clark Stevens is making a detailed study of the Growth of White Pine groups.

Dorothy Smith, the President of Phi Chapter, is making an Ecological

Survey of Wheelwright Pond with especial reference to the Porifera. A study of the biotic communities and a detailed chemical analysis of the water of the pond is now in progress. This pond is practically free from pollution and will be used as a norm for future studies of the fresh waters of the state.

George White and Ralph Meyers are making a study of recent minor oscillations of sea level in the region around Durham, N. H. and marine deposition of Glacial sediments.

The Treasurer of Phi Chapter, Walter Chipman, is interested in the effect upon the offspring of prenatal feeding of caffein to albino white rats.

Leon Glover, a graduate student in Entomology, is working on the toxicity of soap in insect sprays.

C. W. French is attempting to initiate a growth of cancerous tissue by the feeding of refined fats to rats.

Theodore Karabelas is attempting to determine the effect of thyroid when injected directly into the yolk and albumin of the fertile egg before incubation.

Robert Smith is following the same line of investigation and is injecting anterior lobe pituitary into the yolks and albumin, intending to raise the chicks to maturity.

Alfred Hebert is completing for his Phi Sigma thesis a series of embryological mounts of various stages in chick embryological development.

Cavett Prickett is making a series of models depicting cell division, for his thesis in Phi Sigma. He is now attempting to perfect methods of modeling chick embryos.

Read The Biologist

Retrospect of Phi Sigma

(Continued from Page 8)

tory which began among the biologists in Ohio State University in 1915, as has also been our Secretary, Dr. Reed, he is particularly well fitted for his new position.

If the interest, the enthusiasm and the power to carry on in Phi Sigma which has been characteristic of Dr. Reed is at all typical of those early members of Alpha Chapter, Phi Sigma is particularly fortunate to have two such splendid men among the leaders of our society.

In looking back, we have seen remarkable progress during the past three years; in looking forward, we see wonderful possibilities of constructing, on our already firm foundation, a strong, substantial superstructure under the enthusiastic leadership of our newly elected President, Dr. Paul B. Sears. Therefore, on behalf of Phi Sigma, we at this time extend a cordial greeting to Doctor Sears, and express to him our fervent wish that throughout his term of office he will have sincere cooperation from each and every member and chapter in Phi Sigma.

Read The Biologist

Mind Reading

Small boy at the zoo, looking at the stork: "Mother, I believe he is trying to see if he can remember me."—*Lyre.*

Botany in America and Phi Sigma Sustain Further Losses Through the Sudden Death of Three of Her Nationally Known Leaders

THE death of Doctor Edwin B. Payson, professor of Botany at the University of Wyoming, on May 15, 1927 at the age of 34 years, brought to a close a brilliant career in the hour of its richest promise and caused great grief to all who knew him. His untimely death was the more tragic because it came at a time when he was preparing to leave for Europe under the provisions of a Guggenheim fellowship.

In the many tributes that have been given him, one finds an expression of the high esteem that he commanded during his life. A member of the community in which he lived said: "Doctor Payson was unquestionably not only the most brilliant of the younger members of the Wyoming faculty but he was a man of such breadth of vision and possessed of such a rare sympathetic understanding of both men and things that he entered into the life of all with whom he came in contact in a most extraordinary way." A Dean of the University of Wyoming expressed himself as follows: "Edwin Payson was highly respected by all those on the University campus who came in contact with him. The scholars respected him for his scholarship; the humanitarians for his sympathetic attitude towards students and fellow workers; the executives for his sound judgment and frank, honest opinions; the ex-service men for his war record; and the research workers for his contributions to science."

Doctor Payson was a member of the University community for fourteen years, first as a student and leader in campus life, and later as a member of the faculty. He attended Washington University, St. Louis, from September to December, 1917, leaving to enter the service of the United States during the World War. He saw service in France and Germany in the 356th Infantry, A.E.F. In 1919, he was an A.E.F. instructor in the University of Beaune, France. Following the war, he returned to Washington University as Research Fellow and then as Teaching Fellow. During this time he received the degrees of Master of Arts and Doctor of Philosophy.

Doctor Payson returned to his Alma Mater in 1921 as Associate Professor of Botany, and in 1925 was made full professor in recognition of his exceptional gifts as instructor and his contributions to research. As a member of the faculty, he was an able and indefatigable worker in many branches of administrative activity.

Despite the exacting demands of class work and administrative activities, Doctor Payson found time to prosecute extensive research in his chosen field of Taxonomic Botany and was the author of numerous publications.

Memories of the friendship of Edwin Payson are among my most cherished possessions. He possessed the highest ideals, and the least injustice particularly excited his sympathy. He was not given to hasty opinions or ill-advised actions, due to his rare judgment, broad sympathy and remarkable background of knowledge. These qualities, together with an unfailing good nature, made him a lovable and charming companion.

—GEO. M. ARMSTRONG

Dr. Clifford Farr of Washington University Dies of Pneumonia

Had Lately Distinguished Self by Research in Botany

Dr. Clifford Farr of Washington University, who became ill suddenly last Tuesday evening with pneumonia, died yesterday at Barnes Hospital. Dr. Farr, an associate professor of botany in the Henry Shaw School of Botany, Washington University, was 39 years old, and lived at 244 Rock Hill road, Webster Groves. He had lately become distinguished for his studies in the function and growth of plant cells.

Funeral services are to be held at 4 o'clock this afternoon, from the chapel at 4449 Olive street. He is survived by his wife, Mrs. Wanda Farr; a son, Robert, 5; a brother, Clarence E. Farr of Iowa City, and a sister, Mrs. Willard McCune of Los Angeles.

Born in Iowa

Born in New Hampton, Ia., Farr studied at Iowa State University and Columbia University, and when 27 years old was made assistant professor of biology at the Texas Agricultural and Mechanical College. In 1919 he became assistant microscopist of the Department of Agriculture, Bureau of Plant Industries, and the following year became an assistant professor of botany at Iowa University.

He came to St. Louis in 1925, where he has attracted the attention of scientists by developing a method of studying plant growth by microscopic study of root hairs. Mrs. Farr assisted him in his research work.

Magazine Contribution

Dr. Farr is also known for his contributions to scientific journals and to the Atlantic Monthly. He was a member of Phi Beta Kappa, honorary scholastic fraternity, and of Sigma Xi, honorary scientific fraternity. Also he held memberships in the American Association for the Advancement of Science, the Botanical Society of America, the Society for Experimental Biology and the Torrey Botancial Club.—*Globe Democrat, Saint Louis, Feb.* 11, 1928.

Clifford H. Farr

Few men have contributed as much to the world of knowledge, and achieved as striking a degree of success, as did Clifford Harrison Farr in his short but intensive life. His original and enlightening research in botanical science, carried on vigorously since his graduation from the State University of Iowa in 1911, obtained for him a national reputation as a leader in the domain of cytology, a recognition which came to him only a few months before his sudden and tragic death on February 10, 1928.

PROFESSOR FARR

Dr. Farr was born in New Hampton, Iowa, in 1888; he completed his undergraduate work at the State University of Iowa in 1911 and received the M.S. degree there in 1912; and obtained his doctor's degree from Columbia University in 1915. He began his teaching career at Columbia in 1915, and later taught at Rutgers University and Texas Agricultural and Mechanical College. In 1919, he became assistant microscopist to the Bureau of Plant Industries, Department of Agriculture, and from that position went in 1920 to the State University of Iowa as assistant professor of botany. He came to Washington University in 1925 as associate professor of botany in the Henry Shaw School of Botany, and continued in that position until the time of his death. Dr. Farr held numerous scholastic honors; he was a member of Phi Beta Kappa, Sigma Xi, Phi Sigma, the American Association for the Advancement of Science, the Botanical Society of America, the Society for Experimental Botany, and the Torrey Botanical Club.

Dr. Farr possessed in high measure the rare quality of originality. All of his work, both scientific and literary, is stamped with the mark of his own individual thought and reflects the ingenious personality which was forever looking for something new—a new problem, a new philosophical interpretation of biology, a new type of examination for his freshmen (one of his students remarked that Dr. Farr went into trance states a la Edgar Allan Poe to obtain the new pedagogical tricks with which he constantly confronted his interested beginners), new ways of improving his technique and his laboratories. This last he was especially interested in, and the erection in 1927 of the Rebstock Hall of Biology was the consummation of all his ideas as to perfection of laboratory construction and equipment; the University gave him the task of designing and outfitting carte blanche the laboratories of the botany department, and the ultra-modern botanical workshops, so recently finished, stand now as the most appropriate and most permanent memorial that could be erected to him.

Dr. Farr's originality in cytological research won him early distinction as an extremely promising scientific investigator. His first work, which led to his doctor's degree, was on the subject of furrowing in pollen mother cells, a phenomenon discovered by Dr. Farr and studied in detail by him and Mrs. Farr. It was long supposed that pollen cells arose by cell plate formation through the spindles of the mother cells, but Dr. Farr's researches showed that peripheral furrows which grew inward caused the division of the pollen mother cells. This investigation opened up a new and unlimited field for cytological study, a field which has been only slightly explored. The other original problem studied by Dr. Farr, which has just recently commanded nation-wide interest among botanists, and which has earned a national reputation for its author, is the relation of root hairs to plant growth. This subject, also a new domain awaiting the inquiries of future botanists, is concerned with the effects of certain salts upon the physiology and cytology of root hairs. Dr. Farr had published a series of papers on the subject, and was preparing another set when he became ill; he worked on his last paper the afternoon before he was removed to the hospital—he read and corrected the printer's proof and stained root tip sections before he left his research room for the last time.

Dr. Farr's individuality extended beyond the realm of pure science to that of philosophy and literature—he enjoyed writing, and was an essayist and thinker of no small ability. His best-known essay is "The Philosophy of Growth", published in the Atlantic Monthly which attracted the favorable attention and comment of various first-magnitude members of the world of letters. Dr. Farr also wrote other papers of a less profound nature, the outstanding one of which is the instructive and amusing "Psychology of Plants", which likewise appeared in the Atlantic Monthly. It is an excellent example of Dr. Farr's clever wit, and is popularly known among his friends as the "fudge sundae" essay. Dr. Farr was beginning the preparation of another essay for the Atlantic when he died; in answer to the inquiries of the writer concerning the article he said, with a laugh, that the nature of the new essay was a secret, but that it would probably be an antidote to "The Philosophy of Growth".

Dr. Farr's was a most outstanding personality; he was forceful and original, genial and kindly, a man of brilliant intellect, great achievement, and greater possibilities. He was that extremely rare and extremely precious combination which is responsible for the upward progress of mankind: a careful scientist, an accomplished scholar, a sympathetic teacher, and a true gentleman. His death, so sudden and tragic, seems cruel and unreasonable, but the words of Dr. Bradley lend a consoling view: "Let us not grieve because he has gone, but let us be grateful and happy that he has been here to point out the truth to us, to help us, and to inspire us to nobler and more worthy deeds. Truly he was, and still is, a great man."

—Harry J. Fuller, Iota Chapter.

Doctor Bruce Fink of Miami University who died suddenly in his laboratory on the morning of July 10, 1927, was the leading American authority on lichens and one of the two most eminent lichenologists in the world.

A full account of his death was mentioned in the last number of The Biologist.

The Characteristics of the Scientist

(1) Sincere and open-minded; not diverted by personal interests.
(2) Alert and alive to truth, vital; not complacent.
(3) Poised; not excitable, hysterical or melancholy.
(4) Discerning and thorough; not superficial.
(5) Accurate; not indefinite.
(6) Inventive and constructive; not lacking initiative.
(7) Independent; not suggestible.
(8) Thoughtful and persistent; not merely impulsive.
(9) Industrious and energetic; not lazy and dilatory.
(10) Executive; not haphazard.

Intellectual Immoralities

(1) Carelessness in observations, "sloppy work."
(2) Inaccuracy in determining units to be counted in statistical research.
(3) Slovenliness in logic, fantastic explanations.
(4) Generalizing beyond one's data.
(5) Confusing opinions with knowledge.
(6) Confidence in the results of research in disregard of weakness in proof and verification.
(7) Contentment with "discussion."
(8) Poor judgment in research plan and procedure.
(9) Wavering interest, flitting attention, attracted by peculiar superficialities.
(10) Egoism allowed to crowd one to the invention of "new" theories for personal distinction.

Strangers Now

Pop (to his bright offspring)—What's wrong?

Son (twelve years old)—I just had a terrible scene with your wife.

—*La Vie Parisiene.*

Notes on the Council Meeting

NASHVILLE, Tennessee, December 28, 1927, Annual Council meeting of Phi Sigma Society. Present: Cutler, Keefe, Stewart, Reed, Davis, and Mrs. Davis.

Petitions

A petition from the University of Southern California was presented and the Council unanimously voted to recommend to the chapters that it be granted. Prospective petitioning groups were discussed, and it was agreed that the group in Davidson College should not be encouraged any further; and that Vice-President Keefe should investigate the possibilities of a chapter at Lawrence College. Letters from Beta Chapter discussing the negative vote of that chapter on the Mount Union petition were read and discussed, and the secretary instructed to reply thereto in behalf of the Council.

Association College Honor Societies

It was moved that the secretary be instructed to apply for the admission of Phi Sigma into the Association of College Honor Societies.

Phi Sigma Coat of Arms

It was moved, seconded, and carried, that the question of a revision of the Coat of Arms be referred to the committee on the revision of the ritual. Letters from various chapters requesting a revision of the financial system were read, and it was unanimously voted that the financial situation must remain unchanged, at least until the next convention.

Paul B. Sears, President

Nominations by chapters and Council members of candidates for presidency to fill out the unexpired term of President Cutler who recently resigned, were presented. From these Dr. Paul B. Sears, head of the Botany Department, University of Oklahoma, was selected unanimously.

The secretary was instructed to write to the secretary of Phi Chapter regarding the report that this chapter was refusing to consider candidates for membership from departments other than from the Zoology Department.

Editor Requests Relief from Duties

The policies and operation of The Biologist were discussed at length, and suggestions made to the editor governing future policy. Editor Davis requested that he be relieved of the duties of editor as soon as it could be conveniently arranged.

Manual of Instructions

The secretary, treasurer, and editor were instructed to prepare a manual of instructions to petitioning groups, and to submit copies to the Council members for additional suggestions.

Convention Programs, New York, 1928

In regard to the convention to be held in New York in December, 1928, it was voted that this should occur on December 26-27; and that the first day be given over wholly to legislation followed by a dinner in the evening; that provisions be made for registration of all members attending; and that reports of chapter delegates should be written and filed instead of being given verbally as heretofore.

That the second day should be given to the scientific program which should be open to all young investigators in biological fields, whether members of Phi Sigma or not; that papers may be presented by the author, read by title or read by delegates or other active members or faculty members who chance to be present; that the state academies and other small scientific groups be requested to foster a prize competition among undergraduate research workers, the only reward being a part or all the expenses of a successful competitor to New York and a presentation of the paper on the Phi Sigma program; and that all such papers may be entered in competition on the Phi Sigma program, the prize being the sum of not less than $50.00 nor more than $100.00, to be taken from the treasury of Phi Sigma.

Appreciation for Dr. Cutler's Services

In conclusion, a vote of thanks and appreciation was extended to Dr. Cutler for his services as president of Phi Sigma during the past three years.

Eighth Wonder!

Funny they call a car "she" when a man can control it.

—*Sporting Times.*

Southern California Has Now a Place in Our Sun

AT the beginning of the past year Dr. F. M. Baldwin, who has had experience in dealing with marine problems at the Marine Biological Laboratory, Woods Hole, Massachussets, has joined the staff at the University of Southern California as professor of Zoology.

Of the twenty graduate students in zoology at the present time, fourteen are pursuing some investigations along the line of marine biology.

The Anton Dohrn

The Marine Station launch, The Anton Dohrn, owned by the University, and fitted for dredging, trawling, and making marine plankton hauls, etc., has made over 246 expeditions. This is a fine record for a boat which has been in service since 1911. The launch was used very little during the period of the war. One thousand feet of steel cable can be brought into use from her decks for dredging and trawling.

Biology Research Fund

We are all interested these days when we find funds stipulated for assisting biological students engaged in research problems who through some unforeseen exigency can not finance travel, apparatus or collection of materials not covered by the appropriations from the universities for their needs.

The Biology Honor Society, University of Southern California, formerly an independent society, referred to as a chapter of Phi Sigma, is the latest to establish a research fund for this particular purpose. The award is made upon recommendation of a committee composed of two faculty members and two student members of the local society. Aid is also given to worthy students who are in personal need.

Read The Biologist

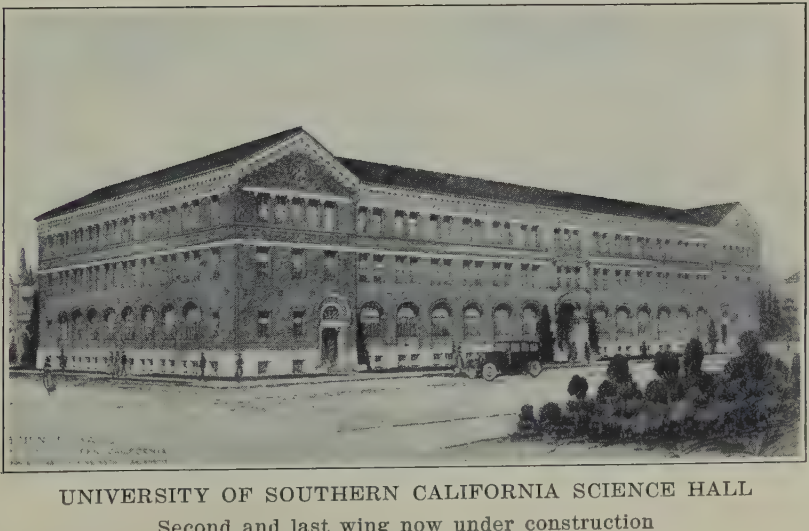
Employment Bureau

POSITION WANTED

EXPERIENCED BACTERIOLOGIST, Ph.D., 8 years experience in 3 state universities, desires change for teaching position with better research opportunities, or public health laboratory position.

Correspond with C. I. Reed, Secretary Phi Sigma, Baylor Univ. Medical School, Dallas, Texas.

UNIVERSITY OF SOUTHERN CALIFORNIA LAUNCH
"ANTON DOHRN"



UNIVERSITY OF SOUTHERN CALIFORNIA SCIENCE HALL

Second and last wing now under construction
Ready for occupancy Sept. 1, 1928

How to Write a Good Journal Article

With Suggestions to Chapter Editors for the Preparation of News Items and Articles Submitted for Publication in The Biologist

The Importance of Meritorious Manuscript

I AM trying to show the necessity for care in the preparation of manuscript. In the first place it has become necessary for the magazine editor to carry on an extended correspondence with the chapters in order to satisfy a constantly increasing number of requests for information concerning the preparation of chapter news letters and journal articles. Unnecessary correspondence is a busy man's curse; it steals his time, if not his money. In the second place, too much of the editor's time is consumed by having to rewrite news letters which arrive in a condition such that they are unfit for publication until completely rewritten. In such instances he must decide whether to revise or to discard the material. To reject another's manuscript is something which every editor is loath to do. Time has an importance to this editor such as to challenge each contributor to think twice before he or she would submit a report such as to necessitate its complete revision.

If you write, there are those who will surely criticise what you have written unless you hold your style to a standard which is beyond reproach. Nothing is so permanent as a printed word; it outlives all the deeds men do.

The first and unquestionably the severest critic should be the writer himself. Few of us are capable of giving our work impartial and cold-blooded scrutiny. Unfortunately, most of us are content to sacrifice accuracy in stating technical and detailed information, care in grammatical usage, clearness, spelling and punctuation, for greater speed and for a supposedly more popular style. In spite of our tendency, however, we are forced to acknowledge that the man is superior who gives careful and repeated reflection to the ideas which he is trying to carry home.

Schopenhauer divided writers into three groups. The first and by far the largest group wrote without thinking; the second thought and wrote at the same time; while the third group, a very small one, thought before they ever began to write.

The second critic is the magazine editor who has a right to expect that reasonably rigid standards will be maintained in the articles published in the journal which he edits. Doctor Allen, who heads the Office of Experiment Stations, U. S. D. A., has recently said, "Carelessness is intolerable, a reflection upon the author which cannot be shifted to the stenographer or the printer, even though these may be found at fault."

The third critic, and commonly the most severe one of all, is the reader. Unless the articles have real news value, unless their style is such as to gain and hold one's attention, a reader may browse through a magazine from cover to cover without having his interest aroused beyond an occasional glance at the beginning or the last few paragraphs. The successful writer must bear in mind that every reader is a potential critic and for that reason he must write his best. If an editor of chapter news was to consider that each time he wrote, his printed words were to be filed in orderly arrangement on the shelves of his college library, or upon shelves in his own library and consequently would be safeguarded there for this and coming generations, would he not exercise the utmost care in the preparation of his copy?

Hints to Contributors

Having considered, above, reasons for improving copy beyond the haphazard and careless state in which it not infrequently arrives upon the editor's desk, it behooves us to consider, briefly, ways and means for raising standards and for improving style.

The Does

1. Do employ critical judgment in selecting and in presenting material. Be painstaking.
2. Write intelligibly, understandingly, concisely, logically, and with clearness of thought.
   "The choice of words, the order in which they are arranged, the sequence of clauses composing sentences, and finally, the arrangement of sentences in a paragraph are important features in effecting clearness."
3. Choose your words with care. Make each sentence convey but one idea.
4. Use the dictionary frequently and increase the vocabulary.
5. Punctuate so as to bring out your meaning.
6. Remember your reader. Be sympathetic toward him. Learn to lay your mind alongside of his. Conserve his time.
7. Stick to the facts. Accuracy of fact and statement will safeguard you against trouble and severe criticism.
8. Write according to a well thought out plan or outline. Think and then begin to write.
9. Have a title to your news article which describes, arouses interest and even curiosity at the first glance.
10. Prefer criticism before, rather than after, publication. It is usually more agreeable.

The Don'ts

1. Avoid loose and indefinite expressions; a verbose and tedious style.
   "The wrong word derails the thought; the needless word is an obstruction."
2. Do not communicate the false or imperfect impression.
3. Don't be careless. Carelessness arouses suspicion.
4. Don't fail to give credit, where credit is due others who have labored to build the foundations, about which you are writing.

5. *"Don't overestimate the reader's knowledge and don't underestimate the reader's intelligence. He may not know as much as you do about this particular thing—let's hope not anyway—but otherwise he may be as bright as you are—let's hope so anyway."—Dr. Slosson.*
6. Don't shoot in the air. Aim at somebody.
7. Don't forget to answer your reader's questions, 'Why?', 'What for?' or 'Well, what of it?'
8. Don't repeat; finish up each topic as you proceed.
9. Avoid qualifying your statements unnecessarily or too extensively.
10. Don't draw conclusions where there can be none. Don't go beyond the facts. Avoid sweeping generalizations.

The Technique of Presentation

The technique of presenting an article for publication should receive great care and consideration from every author, and no less from the great than the small. To do otherwise is to hinder the normal efficiency of an editor and results in waste of his time and his energy.

A style manual is often provided to facilitate public printing. The Biologist needs no scheme which is quite so elaborate; however, it should have and does need a compilation of rules and suggestions to serve as a guide to chapter editors and active members who may submit material for publication.

These rules should be distributed and filed so that they may be readily accessible to anyone who is concerned. They should be placed in a permanent file.

If those submitting copy for publication will carefully observe the following suggestions they will contribute materially toward a better magazine and a higher standard for The Biologist.

The Copy

1. Copy should be typewritten always, and only the first sheet sent to this office, for the first sheets are much plainer than the carbons.
2. Copy should be sent flat, never rolled, pages numbered consecutively, and always complete under one cover if possible.
3. If a publication is composed of several parts each to be printed in separate numbers of The Biologist, a scheme of the desired arrangement should accompany the first installment of copy.

Typographical Details

1. Write on one side of the paper only.
2. Always double space as this facilitates the printer in handling the copy. We have to rewrite single-spaced copy. This is expensive in money and time.
3. Use standard size typewriter sheets 8½"x11".
4. Check for all typographical errors. Correct by drawing a line diagonally through the letter accompanied by the **correct letter as example: "C$\overset{a}{\cancel{o}}$t" or as example: "sc$\overset{\frown}{ei}$nce pr$\overset{o}{\cancel{a}}$gram."** Never mark over the outline of the original letter or word to correct an error.
5. Proper names, foreign words, and technical terms should be typed correctly and verified. Illegible signatures, letters and figures should be rewritten. Corrections of figures should not be written over the originals.
6. Abbreviations should not be used unless they are to be printed as written, in which case they should be accompanied by the word "follow" written on the margin of the page opposite in pencil.
7. Photographs, drawings, etc., for illustrations should accompany the manu-

script, unless requested in advance of the manuscript by the editor for the purpose of having cuts made. Each should bear the title of the article in which it is to be inserted and the figure number. The proper place for each illustration should be indicated on the copy by title, legend or by a penciled outlined space, the size and shape of the accompanying drawing or photograph. If a caption is used to accompany the drawing of photograph, by way of explanation, it should be printed conspicuously or typewritten below the lower limit of the space referred to above.

College Degrees

Lower-case college degrees when spelled, as degree of doctor of laws, degree of master of arts, etc.

Scientific Names

1. Capitalize the names of genera, families, orders, etc., as *Cicada septendecim* (the first the name of the genus, the second the name of the species), belongs to the family Cicadidae. The genus and species should be underscored in the copy when they occur together, in order that they may be italicized.
2. *Usually* the species name is in lower case, not always.
3. The authorities for a species should be followed by a comma when the name is spelled out in full, and by period only, when the authority name is abbreviated.

Citation for "The Grist We Grind"

1. The following method should be followed in every instance where the article has been published in other periodicals and the reference is included in The Biologist under "The Grist We Grind."
   Form: Last name, Initials. Exact title to article.
   Example: Eckerson, S. H. An organism of tomato mosaic.
   Form: Journal Volume: pages. plates #, figures #. date.
   Example: Bot. Gaz. 81:204-208. pl. 19-22, figs. 1-2. 1926.
   Form: Chapter.
   Example: Zeta.
2. If the reference is to a *book*, the following form should be used:
   Example: Ellis, C., and A. A. Wells. The chemical action of ultra-violet rays. N. Y. Chem. Catalog Co. 362 pp. 1925.
3. If the citation refers to incomplete work or to the titles of papers in progress of completion, the citation should be given as follows for "The Grist We Grind."
   Form: Dr. (Mrs. or Miss) initials or first name, last name, dash.
   Example: *Dr. T. H. Goodspeed*—Cytology of hybrid plants and genetics, with special reference to *Nicotiana tabacum.*
   Example: *Nellie Tegland*—Marine Oligocene of the State of Washington (with particular reference to moluscs). See: "The Grist We Grind" in The Biologist.

Chapter News Letters

1. Submit them promptly, twice yearly on or by October 1, and March 1.
2. Write the name of your chapter in large caps and center it above the heading to the article.
3. Make the title suggestive, promote interest and awaken curiosity; but keep it short.
4. Follow the title by your full name.
5. There may be as many sub-heads interspersed throughout your report as befits its content.
6. There is a place under the heading, "The Grist We Grind" providing for all citations to research papers. Do not include a formal array of them in the body of your news letter.

Proposed Basis for Chapter Reports

An outline of topics suggesting subjects suitable for consideration in connection with chapter news reports.

Alumni News
Chapter Activities: Have suitable subtitles for the news you wish featured.
  Meetings:
    Average number in attendance:.........., faculty............, visitors.............
    Nature of meetings: scientific programs............, outside speakers, student papers, social programs, initiations, etc.
  Chapter projects:
    Scholarship funds, prize awards, "Biologist's Day," "Open House," scientific lecture series, etc.
  Outings, field-trips, interfraternity activities, etc.
Research among members:
  Recently published scientific manuscript:
    Author's name.............., *exact title* of the article.............., journal................, Vol..............., pages inclusive.............., date............, or possibly a brief summary stating the nature of the problem, the methods employed and the conclusions drawn.
  Digest of the research being undertaken by the personnel of your chapter. Send out return postal cards asking each to state in a single sentence or two the titles of his research problems.
Number of candidates for degrees:
  Bachelor, #..............., Master, #..............., Doctor, #.............
High scholarship awards:
  Press comments; send newspaper clippings.
  Vital statistics.
Questions which might receive answer within the body of your chapter news report:
  How many active members engaged in research projects?
  How many have published manuscript?
  What measures are you taking on the campus to popularize biology? Describe them.
  What plan do you follow in obtaining new members? How does it work?
  Are you in any way attempting to keep in touch with the younger alumni? If so, how?
  How does your chapter "bat scholastically" as compared to other honorary societies? What position does Phi Sigma hold in this respect? Use curves to illustrate our place.
Special contributions from the editor:
  "The Tripotage" (which means according to Webster, "The Jumble").
  Feel welcome to make any comments whatsoever in this column.
Photographs:
  Poems (of biological nature, humorous or otherwise).
  "Chaff" jokes, stories, songs, etc.
Caution:
  In using this outline do not allow your report to lose spontaneity and individuality. It is not meant for you to follow mechanically.

Read The Biologist

Photographic Prints of Leaves

Photographic prints of leaves (particularly collections of typical tree leaves) are easily made and are far more desirable for most purposes than are the pressed specimens. A six by eight-inch printing frame, some photographic printing paper of the same size and some developing solution are the only materials needed. The leaf is used as a negative, and by regulating the exposure the veining as well as the leaf outline will appear clearly upon the print. If a large collection is to be made, blue-print paper will be found more economical than photographic printing paper.

—*Turtox News.*

Wedding Bells

AT Urbana, Illinois, on December 27, 1928, N. A. Pettinger, alumnus and former president of Rho Chapter, was united in holy matrimony to Miss Bernice Phillippe in the presence of 36 guests. A reception was given in honor of the newly-weds immediately following the ceremony.

With the customary delay in train service on such occasions, the bride and groom left for Chicago in a storm of merry-making. Rice was abundant. After a brief stay of two days in Chicago, a week was spent in the home of the groom's parents at Creston, Iowa, whence the bride and groom returned to Illinois to spend several days with the bride's parents at Champaign. The usual pranks were successfully weathered and tolerated.

Dr. and Mrs. Pettinger are now at home in Blacksburg, Virginia, where Dr. Pettinger is employed as Associate Agronomist by the Virginia Agricultural Experiment Station. They had the opportunity of making their home in either Alaska, Virginia, or Florida. Virginia was chosen because of the splendor of the natural scenery in the Blue Ridge region and because of the lack of the extreme Alaska and Florida temperatures.

Christmas nuptials have been unusually popular this year. During the Christmas holiday, two members from Phi Chapter were married; so, on February 23 they were given a Leap Year party in the form of a mock wedding by the chapter. The young couple were showered with small gifts and everybody thoroughly enjoyed the huge pieces of wedding cake and other refreshments which were served after the gifts were opened.

Kappa Zoologist Invites Closer Understanding With Pittsburgh Botanist

The Pair are Trying the Matrimonial Experiment

It was another biologist's wedding when the church bells rang for S. T. Brooks, (Kappa '24), who married Miss Betty P. Watt, a student of botany at the University of Pittsburgh. They were married in April, 1927.

Mr. Brooks is now working at the University of Pittsburgh toward his Ph.D. degree. He was recently appointed custodian of Invertebrate Zoology in the Carnegie Museum on the campus, an honor which has come to him following the death of the past curator, A. E. Ortmann, January 2, 1927.

How Unusual!

Acquaintances are sometimes wont to exclaim, "How unusual!" at two young things keeping abreast in identical professions, struggling with identical problems and wanting all the while just to get married. They are apt to overlook the fact that Nature herself is the only perfect match maker.

Consider the multiplicity of her mysteries; you find them hidden deep, whether in the forest, in the ocean's depths, or whether they are to be found in rocks, test tubes or on microscope slides. Nature may mask herself in a thousand different ways but no matter if she is as barren as the timber line or as repelling as a muddy pool, she excites man's curiosity, fires his imagination, awakes his benumbed mind, and invites him to pitch his best skill against hers. Thus man and woman must be in tune with nature if they will understand her. Rarely is a biologist found who shows boredom at the finer and intimate beauties of Nature.

But the road to complete understanding is long and hard. It leads through years of intensive study, and these must be punctuated by a purpose so profound that the will and the desire will not waver against extreme discouragement and loss of faith. Frequently the biologist who travels this road is burdened with severe handicaps. Sometimes health is sacrificed to gain what seems to be a glorious end. There are no markers to point the way where man's thoughts steer through unknown forests. It is as an uncharted sea, scourged with confused opinions, myth, prejudice, and fantastic explanations. His life may be spent also without acquiring that luring wealth which makes ease and luxury for many. All that I have said is known to be true, but this realization does not keep hundreds and thousands of men and women, chosen from among our great and small universities, from making scientific biology their life-long career.

While the lone man may sometimes haunt Nature's back doors to find "sermons in trees," to give solace to an anguished heart or find songs to smooth a furrowed brow, or find there a spirit of worshipfulness, the story for the biologist may be quite different. Day after day the biologist is revealing a little more of nature within his laboratory, whether that means a research laboratory and library or one established on some mountain slope. Young men and women, trained biologists, imbued with the spirit of scientific inquiry, are constantly turning their serious attention to nature as well as to her in their play. From such contacts, they are drawn instinctively, as time moves on, to respect and to admire her laws, to enjoy her new revelations. As they thrill at the complexity of all life, they are startled by the illision of the simplest of atoms.

Here we have it then, the Why and the Wherefore, that a nature-loving and biologically trained couple should ever entertain for a single moment one serious thought of matrimony together.

Nature loving as she is, the girl biologist understands the long vigilance before her companion ere they have considered marriage at all. She knows that long years must elapse before wide recognition can be achieved, and is patient. Sympathetic, she can bolster his waning faith; self-reliant, she can assist with capable hands—she has pride in his accomplishments for she knows each obstacle in his way and can evaluate them.

By chance placed together in the same garden, do you still believe it, then, unusual that from some such experiences and thoughts two biologists should choose the life-long comradeship of marriage?

Read The Biologist

Introducing Beta Beta Beta Honorary Biological Society

The Chapter Roll of Beta Beta Beta Honorary Biological Society is as follows:

Alpha,—Oklahoma City University
Beta,—Simpson College
Gamma,—Western State College of Colorado
Delta,—Southwestern College
Zeta,—Missouri Wesleyan College
Eta,—Iowa Wesleyan College
Theta,—McPherson College
Iota,—Marietta College
Kappa,—Thiel College
Lambda,—William Jewell College.

They hold a convention every two years at the same time and place as the meetings of the A.A.A.S.

Editor's Note—To all who may not realize the existence of other national biological societies which share with Phi Sigma this field, it will be of interest to them that SIGMA BETA RHO, honorary biological fraternity, organized at Peru, Nebraska, a year or so ago, has received recognition in the pages of "The Biologist" and no further. The eleventh edition of Baird's Manual does not include them. The above, concerning BETA BETA BETA, on the other hand has been lifted entire from Baird's Greek Letter Fraternity Manual, 1927.

Read The Biologist

No-Sir-ee!

Once Professor Zobo a famous lion tamer who caught them in Africa and sold them to zoos in the United States was inquiring for a helper through the advertising columns of one of our metropolitan dailies. Fact was that his former helper had been chewed to pieces by one of these ferocious beasts. While staying in the city he made his headquarters known for such and such a hotel. Evening came and as usual he retired for the night at 11:00 o'clock. At 2:00 he was awakened by a continuously loud thumping at his door. He finally got up, went to the door and the following dialogue took place:

Red-nosed Canary Outside—"I shay—(hic)—perfessher—hic—hic — you szwon who advertized fur ashsistzance in—in Afri-cah—hic—a?"

Inside—irritated—"Yes sir. Well what about it, at this hour?"

Outside drunk—"Well—pro-professher, I comes ter tell yuh, under no shircumstanzes would I go."

In Effect Phi Sigma Has Her Colonizing Plan, Too!

Club at U. of Pitt. an Offshoot From Her Maternal Stem

A WELL perfected scheme preceding but eventually leading to the installation of new chapters is practised among many of the larger, more successful and most conservative academic fraternities of this country. In details of execution the plan may vary, possibly, in each of the national organizations but in each instance it is in reality a device to insure enlargement at a fixed and uniform rate.

Local chapters conceived to conform with the standards of the maternal society and schooled in her ancient traditions are initiated from particular universities and colleges in the favored geographical section of the nation. In many such instances the plan works by having local alumni from the fraternity band together to make the initial start. The college boys are made acquainted with this local organization of fraternity alumni, are rushed and pledged in the usual manner. In this way a local club is begun. The relationship between the offshoot and the maternal stem may be as close as adopting mother to foster son or as loose as the relationship may be between two distinct but affiliated groups.

There are two reasons for the popularity of this scheme among conservative fraternities. The organizations which have tried the experiment of colonizing before initiating to chapterhood have discovered that such clubs are readily managed because they are flesh and blood from the same stock; and in the second place, because the plan insures a normal growth whereby a fraternity may strengthen itself in localities which for the time being, at least, seem to the society especially desirable.

Such a plan has Phi Sigma seen fit to adopt in connection with a local club of Phi Sigma Alumni origin in the University of Pittsburgh. This club was started in the fall of 1927, and the results to date have been chiefly due to the enthusiastic and whole-hearted efforts of S. T. Brooks, formerly of Kappa Chapter, now Custodian of Invertebrate Zoology in the Carnegie Museum, University of Pittsburgh.

It has occurred to the writer that no one in our society fully appreciates the fact that we are in this instance following, in effect, a colonization plan. Mr. Brooks has written to the National Secretary a letter from which your editor has been permitted to quote as follows:

"You no doubt remember my letter of last April about organizing a group here at the University of Pittsburgh. Well it has been done and with the best of results. Everyone is very, very enthusiastic over it and all are helping.

"We have about twenty-one active members and the remainder to thirty are faculty members. We are trying to form a perfect society which, of course, is impossible.

"We are following a revised edition of Phi Sigma constitution. I wrote the whole thing myself, based on my happy and more sad experiences with Kappa Chapter.

"I am very proud of the help the faculty gives. They aid financially, mentally, and give much impetus to the work.

"My purpose in writing you is to secure your advice as how best to proceed so that our chances of going into Phi Sigma will be most likely."

As just seen, the parallelism to fraternities which have a well formulated program of colonizing, may in such cases, be close. In this instance we are unlike them for we are paying little or no attention to the geographical needs of our organization. As additional evidence for the existence of this parallelism Phi Sigma owes the recent acquisition of chapters at the Univ. of Southern California, Univ. Oklahoma and Univ. Washington to influential and interested alumni members residing locally at these institutions.

If our Council would see fit to consider and to work out plans for extending our society, using some such scheme as colonization as a basis for their operations, we would be in a position to restrict growth in certain parts thus enabling us to avoid entirely certain institutions, while having definite plans for encouraging development in the desired areas and institutions throughout the country.

Read The Biologist

Many Phi Sigmas Seeking Biological Stations as Summer Plans Mature

Dreams of delightful weather just ahead cause many minds to turn to the biological stations for combining their play with serious minded effort. In recent years universities have seen the wisdom of such a combination for their biologists; consequently many of the larger institutions are inviting investigators each summer to share the shores of their lakes, their forest reserves, and alpine climates, as well as their tide waters. With very little cost one may enjoy a real summer outing and advance his or her particular research projects or avocational inclinations at the same time.

This summer a number of our Phi Sigma members will be looking forward to attending the Biological Station which will be located at the Isles of Shoals, off York and Hampton Beaches. There seems to be great promise that considerable biological research will be accomplished, as the station will be ready for work as soon after college closes as possible.

Read The Biologist

Report of the Inspection of the Biological Club of The University of South Dakota, Petitioners to the Phi Sigma Society

I. The University of South Dakota was founded in 1862 and it has been located at Vermillion since that time. The University includes the following subdivisions: (a) The College of Arts and Sciences, (b) The School of Law, (c) The School of Medicine, (d) The College of Engineering, (e) The College of Music, (f) The Extension Division, (g) The Summer Session, (h) The University High School. There are fourteen main buildings on the campus, and at the present time there are about 1,100 students enrolled in the University. There are 67 members of the faculty above the rank of instructor and in addition to the deans of the various colleges and schools.

II. The equipment of the buildings and of the science departments is adequate for a wide range of work in many of the aspects of modern science.

III. I had an interview with President Robert L. Slagle and I found that he has a very favorable opinion of the work which is being done in his institution in the biological sciences and that he also favored the best support that can be secured for those departments. The University has suffered somewhat because of the unfortunate political tangles in which the state has been involved during the past few years, but the work of the University has not been seriously crippled. The President is of the opinion that brighter days are in the immediate future.

IV. I also met nearly all of the members of the faculty in their offices and laboratories, and I attended an initiation of Phi Beta Kappa and a dinner given by the Sigma Xi Club. These occasions gave me an excellent opportunity to become acquainted with the leaders of the institution and to form an estimate of the point of view and spirit of the campus. I am pleased to report that I was impressed by the spirit of enthusiasm and aggressiveness that pervades the institution. Considerable research work of a high order is being done by most of the departments.

V. I attended a regular meeting of the Biological Club, the petitioning club. There were eighteen in attendance at the meeting, including the faculty members, and two papers were presented by student members. This meeting was of very high order and it could not help but impress the inspector with its quality and with the promising future of the young people who took part. The young men and young women constituting the Club appeared to be of a superior type. They have already been doing much that Phi Sigma attempts to do. The meetings are conducted with dignity and the student members enjoy the full cooperation of the faculty members of the Club. I inspected some of the research work being done by certain members of the petitioning body and it is of an excellent type. The constitution of the Club embodies a good many of the significant features of the constitution of Phi Sigma.

VI. The equipment of the biological departments, although not extensive, is of a very good grade and it contributes greatly to the work and the success of those departments. I gained the impression that the best biological work of a research nature in the institution is being done by the departments of bacteriology and physiology. This is doubtless due to the stimulus of the State Health Laboratory which is on the campus. The work of the former department of biology is now divided between the departments of botany and zoology. These two departments are well equipped and they are doing an excellent grade of work, including some research work. Facilities and materials are at hand for research work on the part of students and staff. I found the common library facilities readily available to students. Professor Churchill of the zoology department, and Professor Abbott of the botany department, have full confidence in the President and the student body, and I was impressed by a fine spirit of cooperation which was in evidence throughout the biological work of the institution. It seems to me that the biological work in the University is in very excellent hands and that the future possibilities for development and for the expansion of research activities are great. There are, all told, about 250 students in the biological departments at the present time.

VII. The inspecting officer was very cordially received by President Slagle, by the faculty, and by the members of the Biological Club. Every possible courtesy was extended and my work was facilitated with enthusiasm by everyone concerned, from the President down to the students who helped show me about the campus.

After a thorough and rather detailed survey of the entire situation involved, I am delighted to endorse the petition of the Biological Club of the University of South Dakota and I wish to recommend to the National Council that the petition of this organization be circulated for a vote of the chapters.

Very respectfully submitted,
(Signed) RAYMOND J. POOL,
Professor of Botany,
Chairman.

Read The Biologist

They Will Not Let Them Fall

This winter an appeal has come to the University of New Hampshire to buy some of the ancient pines in the Franconia Notch of our White Mountains to save these old trees from being cut down and sold. Phi Chapter members all contributed their share to the project which we think has helped to save the beauty of this tract of land from being ruined.

ZETA NEWS

By C. R. Burnham

At our initiation banquet in December we added twenty graduate students to the chapter. Dr. L. J. Cole, Professor of Genetics, who was initiated as an honorary member, traced for us the development of science in genetics since 1900.

Stillman Wright, Zeta—, who has been with the U. S. Bureau of Fisheries, has returned to take his doctor's degree in June.

Through Dr. Duggar's assistance we were very fortunate to secure an illustrated talk by Mr. Arthur Pillsbury, formerly official photographer of Yosemite National Park. His motion pictures of floral movements and especially those of microscopic preparations showing growth of pollen tubes and fungi were remarkable. His methods may be very useful in the study of other biological phenomenon such as the processes of cell division and possibly chromosome behavior. This lecture was open to the public and was well attended by a number of plant science groups.

At a later open meeting, Dr. W. D. Stovall of the Wisconsin State Laboratory of Hygiene, gave an illustrated lecture on some of his work with fungi that are pathogenic to man. Some of the honorary medical societies joined us in attending this lecture.

We have also heard from two of our active members, A. F. Heck on his research with certain soil fungi, and E. A. Marten, on bacteriological studies on sauerkraut fermentation.

At a March open meeting we are to have talks on the investigations of Lake Karluk, Alaska, with motion pictures on Alaska scenery and wild life, and also pictures showing the life cycle of lake salmon. Dr. Willis Rich of the U. S. Bureau of Fisheries is to talk on the biological conditions of the lake and Dr. George Kemmerer, Professor of Analytical Chemistry at Wisconsin, will talk on the chemical investigations.

The following sections have been lifted from the Constitution of the Biological Club of University of Pittsburgh.

PREAMBLE

. . . Recognizing the necessity of and the mutual benefit to be derived from an organization devoted to research in the biological sciences, and a careful investigation into and free discussion of them:

We agree to form an association, and for its government to adopt the following Constitution and By-Laws:

ARTICLE I.

NAME AND OBJECT

Section 1. This association shall be known as the Graduate Biological Research Society of the University of Pittsburgh.

Section 2. The object of this society shall be to promote interest in research in the biological sciences.

ARTICLE II.

MEMBERSHIP ELIGIBILITY

Section 1. The Graduate Biological Research Society of the University of Pittsburgh shall consist of *active, alumni, faculty* and *honorary* members.

Section 2. Any graduate student or instructor of the University of Pittsburgh who is at the time of recommendation engaged upon some research problem, or who has completed some research work, is eligible to membership.

Section 3. This association considers Professors, Assistant Professors, and Associate Professors as members of the Faculty; therefore they are eligible to faculty membership.

Section 4. Alumni members may retain their active membership, if they so desire, by paying the fees of active members as designated in the Constitution, Section 1 of the By-Laws.

Section 5. Faculty membership shall be defined as membership which carries with it no right to vote or hold office but such members shall pay all fees plus the initiation fee, which shall be the same as that of active members.

ARTICLE V.

MEETINGS

Section 1. Regular meetings of the society should be held, if possible, according to the following schedule:

	1st half month	2nd half month
September	0	1
October	1	1
November	1	1
December	1	0
January	1	1
February	1	0
March	1	1
April	1	0
May	1	0

And we should plan to have at least two papers a meeting, which would make 26 papers (total). A good year's work.

By-Laws of the Graduate Biological Research Society

Section 5. Departments of Research considered by the Society as biological are as follows:

1. Anatomy
2. Anthropology
3. Bacteriology
4. Biochemistry
5. Botany
6. Home Economics (X)
7. Entomology
8. Geology (X)
9. Medical Sciences (X)
10. Pharmaceutical Sciences (X)
11. Pharmacology
12. Physiology
13. Psychology (X)
14. Zoology

(In the Departments marked with (X) only those engaged on specifically biological problems are eligible for membership in this Society.)

Read The Biologist

Member of Phi Sigma, University of Wisconsin, Makes Important Discovery

George Marvin First in United States to Find Yeasts in Honey

At the University of Wisconsin a member of Zeta Chapter has been working for a period of a year or more on why honey ferments. A news paper clipping from the Monticello Messenger, December 29, 1927, gives a popular account of his work. The editor of The Biologist has considered his work of sufficient interest to all to include it in this issue:

(From Monticello Messenger
Dec. 29, 1927)

Discovery of five yeasts which cause fermentation of honey has been made by George E. Marvin, entomologist of the Wisconsin College of Agriculture, and former assistant principal and science instructor in the Monticello high school.

Mr. Marvin is the first specialist in beekeeping in the country to conduct research along this line, he believes, and so little has previously been known about the causes of honey fermentation that the five yeasts have as yet been given no scientific name.

Fermentation can be prevented, he finds, by heating the honey to 160 degrees. Fermentation, or souring, is caused, he says, by too great a moisture content. Ordinarily honey contains very little moisture, ranging from 14 to 20 per cent. When unusually wet weather prevails, the moisture content may be raised above 20 per cent, and the activity of the yeasts will cause fermentation. It is not, he points out, any reflection on a beekeepers' methods when his honey ferments, but due usually to the weather.

Mr. Marvin suggests that people who have been eating yeast cakes for health reasons may now find available a yeast cake with a sweeter taste than the commercial product now on the market.

Honey, because of its highly concentrated form, makes an excellent strength-giving food, he says. Football coaches at some Big Ten schools give members of their teams lumps of cane sugar to chew between halves in order to buoy up their strength. He suggests that honey is much better adapted, since it is pre-digested by the bees, and can be immediately assimilated by the digestive tract. Sugar, on the other hand, requires six hours in which to be assimilated, so that the game is over before the team has gained any benefit.

Read The Biologist

Research in Epsilon Chapter

IN order to stimulate research and general interest in Biological Sciences throughout the student body Epsilon chapter is offering a medal to be awarded to the author of the best paper on some Biological subject. Any student at the University of Denver is eligible to compete.

The members of Phi Sigma are interested in a number of research problems. The following is an account of the work being done in the various departments of the university.

Department of Anthropology

Frances Watkins has for her research subject "The Classification of Pottery of the Southwest". Miss Watkins and Dr. Etienne B. Renaud are working on "Skulls of Indians of the Mounds". The Colorado Museum of Natural History is furnishing them with some very rare skulls from which they are taking measurements.

Dr. Renaud has several papers

which are to appear in leading magazines in the near future. "Influence of Food on Culture of the Indians of the Plains" will appear in "Social Science". Dr. Renaud uses the Indians of the plains because he considers them typical. He shows how people depending upon the flesh of the buffalo for food would be nomadic and therefore would have no pottery, no masonry, no towns. Their mythology, religion and art will be based upon animal life. The story of civilization is the story of food getting.

"Social Forces" will print "Evolution of Population and Dwelling in the Southwest". This article deals with prehistoric peoples beginning about 2000 B. C. It outlines the process of stabilizing society. As people became more stabilized agriculture came into vogue and people organized themselves into small social groups. This arrangement made the carrying of water necessary so the art of pottery was developed and with it masonry. As enemies came in a more compact social group was advantageous. This civilization culminated in a large village.

A Paris magazine "Anthropologie" is to publish an article entitled "The Antiquity of Man in North America". This includes a complete survey of recent discoveries tending to prove the existence of man at an early date in North America as based upon Geology and Palaeontology.

At the meeting of the southwest section of A.A.A.S. at Flagstaff in April Dr. Renaud will present two papers. "Papuan and Basket Maker Skulls". He attempts to prove that they are the same physical type and that that type is protonegroid. The other paper is "Prehistoric Female Statuettes". This deals with the post basket maker period of Arizona compared with similar statuettes found along the shores of the Mediterranean. The study shows that the first god was a goddess.

Department of Botany

Several of the problems undertaken by members in the Department of Botany originated in connection with the Rocky Mountain Biological Station which is the summer camp of the Department conducted yearly at Estes Park.

Edith E. Dwyer has chosen the Colorado mountain mushrooms as her problem of study. Tho this is only a preliminary study it revealed much of the habits and histories of the late summer mushrooms. One of the most interesting phases of Miss Dwyer's work is the large number of excellently prepared spore prints of all of the forms studied which remain as permanent records of these plants. The seasonal succession of mushrooms has been an object of study, but much more extended work involving several seasons must be done before any actual contribution to the knowledge of fungus life can be offered.

Pearl J. Parvin is working upon several problems. One of these deals with transpiration in plants. Miss Parvin is also working upon a meteorological problem as to the relation between health and climate. This has been worked out in considerable detail by previous investigators, and an attempt is now being made to check these results against the vital statistics of Colorado.

Pearl J. Parvin and *Henrietta L. Zobel* are investigating the existence of sex hormones in plants, and the effect produced when plants are treated with the hormone.

Leon H. Kelso has chosen a problem in ecology. A swamp in the vicinity of Denver is his special field of investigation. Ecological conditions existing there are being studied in detail, and the dominant swamp species selected for study as to the number of seeds produced and their viability under natural and controlled conditions.

Eleanore F. Windolph is investigating scar tissues of plants, their origin, development, and composition. Contrasts with normal tissues are stressed. Miss Windolph also desires to investigate the nature of scar tissue in animals.

Department of Education

The Department of Education has been working on some problems of Biological interest.

Miss Dorothy Gardner has "Communitative Ideas of Mexicans" for her problem.

Dr. Thomas R. Garth, working in corroboration with his students has several articles ready for publication. 1004 Mexican children have been given intelligence tests. The results of this survey will appear in "School and Society" in the near future. Papers have been prepared on "Color Preferences of Japanese Children" and "Color Preferences of Fillipino Children".

An account of "A Study of Intelligence and Achievement of Full Blood Indians" is ready for publication.

"The Will-Temperament of Indians" by Dr. Garth and Mary A. Barnard appeared in "The Journal of Applied Psychology" in December 1927, and "The Community of Ideas of Indians" by Dr. Garth was published in the September 1927 number of the "Psychological Review".

Department of Zoology

William W. Greulich is preparing a paper upon multiple births among humans with special attention to twinning. Also family histories of the same with reference to hereditary factors.

Ira E. Cutler. Hybridization among the Irises. The work is being done upon two sub-genera which insofar as is known have never been successfully combined. The main reason probably being the wide difference in time of blooming, one being early and the other the latest in flowering. The two are Subgenus—Pogoniris : Iris germanica var. pallida dalmatica and Subgenus—Apogoniris: Iris orientalis or ochroleuca gigantea. Seeds have been secured already and the results will be followed carefully. Also detailed studies of bud mutations among irises and whether variegations of leaves will be transmitted thru the seed.

George Dale—Influence of female

sex hormone on learning ability of white rats.

Barmum, Warren R.—The control of regeneration and head formation in Planaria dortocephala by chemical means.

Crabtree, Edison M.—Studies on the nature of the factors determining regeneration of Planaria dortocephala.

Cutler, Marjorie M.—Reactions of Planaria dortocephala to various chemical and light stimuli.

Owen, Humphrey G.—The effect of changes in temperature and of certain chemicals on the embryological development of Diemyctylus viridescens.

Read The Biologist

Life Is Funny

Man came into this world without his consent and leaves it against his will.

During his stay on earth his time is spent in one continuous round of contraries and misunderstandings.

In his infancy he is an angel. In his boyhood he is a devil. In his manhood he is everything from a lizard up. If he raises a family he is a chump. If he doesn't raise a family he is too selfish. If he raises a check he is a crook. If he is a poor man he is a bad manager and has no sense. If he is rich he is smart but dishonest. If he is in politics he is a grafter. If he is not in politics he is an undesirable citizen. If he goes to church he is a hypocrite. If he doesn't he is a sinner. If he gives to charity it is for show. If he doesn't he is a tightwad. When he first comes into the world everyone wants to kiss him. Before he leaves the world everyone wants to kick him. If he dies young there was a great future before him. If he lives to a ripe old age he is in the way.—*Author Unknown.*

Quietude: A Prayer

God of all flesh, when these my days are sped
Let me but hear the music of the spheres
Or see, far off, the progress of the years
And I shall be greatwhile content though dead;
For to their heavenly music I am wed
And thrill with subtile thrills, no yield to fears.
Thy great to-morrow wipes away all tears
And there, as here, Thy law shall be our bread.
Then let me dwell in some great quiet place
Where I may brood in peace on time's deep things
And all the mystery that round man clings;
For off, mayhap, have glimpse of one sweet face;
And catch the tones of twanging golden strings
Whereto Thy myriad million stars keep pace!

—*Erwin F. Smith*

Reprinted from Science, Oct. 28, 1927, Vol. LXVI, No. 1713.

The verse above was inspired from the heart of the late Erwin F. Smith, noted scientist, dean among men, author, poet and father of American Plant Pathology.

THE BIOLOGIST

Vol. X APRIL, 1928 No. 1

The Occurrence and Characteristics of Certain Yeasts Found in Fermented Honey

George E. Marvin, University of Wisconsin, (*Zeta*)

Introduction

THE fermentation of extracted honey after canning is the cause of much worry on the part of beekeepers in all parts of the United States, whenever a part of crop must be held over during a period of from six to eighteen months. In such instances, it is usually considered that the honey was not properly prepared by the beekeeper, and perhaps it had been extracted before being thoroughly ripened by the bees. However, many recent cases have come to our attention, which show that, even though the beekeeper may have done everything possible in the way of preparing his honey for market, fermentation has appeared after a number of months in storage. The exact details of the cause of fermentation have not yet been completely worked out, but a complete investigation of the effect of storage upon the keeping qualities of honey is now under way at the Wisconsin Agricultural Experiment Station under the direction of Doctor E. B. Fred of the Bacteriology Department and Professor H. F. Wilson, of the Department of Economic Entomology.

At the present time, I am presenting one phase of this problem, upon which I have been working during the past year. This phase consists of a study of the occurrence and characteristics of certain yeasts found in fermented honey. During the course of the work, five different strains of the yeasts have been cultured from fermented honey, and sufficient work has been done with the characteristics of these five strains to show that each one is distinct, and no doubt in the course of future work, additional distinct strains will be found.

Materials and Methods

Samples of Fermented Honey

Strains I and IA. These strains were isolated in March, 1926, from honey which was produced in the University apiary. It had been extracted in August, 1925, strained while cold and allowed to stand in a large closed tank in the extracting room. By the first part of September, this honey had partially crystallized, but would ooze slowly from the honey gate on opening it. It was then allowed to run into wax paper cartons for hardening. Ordinarily, honey becomes quite solid within a month, but, instead of hardening in the cartons, it became more liquid and bubbles of gas were observed by November. Three cartons full were emptied into each of two five pound pails, with the covers put on in the ordinary way. Before long, a rounding of the bottoms of the pails was observed, showing that gas was held within under pressure. These pails were selected for study and from these samples, the first two strains of yeast were isolated.

Strain A. This yeast was isolated from a ten pound pail of honey which was sent in for the Miller Library Fund in October, 1926. The pail was allowed to stand at room temperature for some time. The honey was crystallized and fermentation became apparent from the odor and scum on the surface.

Strain B. This yeast was isolated from a six pound square can of honey sent in for the Library Fund in November, 1926. The honey was of amber color and semi-solid when first received. Due to the odd sized container, the honey was not sold, hence remained in the office for several months. The cover was loosely on and before long, honey began to be forced out. On examination, we found that fermentation had set in. As fermentation continued, the honey became thinner until it could be poured from the opening quite readily.

Strain C. This yeast was isolated from fermented honey brought to the office by a beekeeper in the city. He did his extracting as usual in August, 1926. The honey was strained while cold and put in a storage tank. Some was drawn off from time to time, heated and put in jars and containers for sale. As the season advanced, there was still several hundred pounds in the tank and fermentation became apparent. The beekeeper brought a pound glass jar of it to the office. Bubbles were noticed all through the sample and it looked as if there was a rapid fermentation going on. The sample was crystallized, but as the fermentation advanced, the honey became more liquid.

The Isolation of Yeasts

The Media

Some difficulty was encountered at the beginning of the problem in getting a honey medium upon which to grow the yeasts isolated from fermented honey. Finally, a medium was made up of yeast, water, agar, and honey on which the yeasts thrived.

This medium was made by dissolving washed agar in the yeast water and adding honey. The following proportions were used: yeast water—4 parts; honey—1 part, and 3 percent washed agar. This medium was then tubed for slopes and petri dishes or put in 100 cc. flasks for giant colonies. They were then sterilized for 30 minutes at 15 pounds pressure. If sterilization takes place longer, the honey will caramelize and turn dark. Also, due to the acid content of the honey, the agar will be hydrolized to some extent and then the medium will not harden.

Methods Used In Plating

Three different methods were used in isolating the organisms from a sample of fermented honey—

1.—The honey-yeast water-agar medium was melted and cooled to 45°C. A loopful of the fermented honey was added and after thoroughly mixing, the medium was poured into a sterile petri dish and allowed to harden.

2.—The medium was liquefied, poured into a sterile petri dish and allowed to harden. The hardened surface was then streaked with a needle which had been inserted previously into fermented honey.

3.—Four or five loopsful of fermented honey were put into a tube of sterile water. This was shaken so as to dissolve the honey and the tube was then centrifuged. The clear liquid on top then was drawn off. A loopful of the heavier material on the bottom was used as an inoculant and then the first procedure was followed.

Incubation

The petri dishes thus inoculated with samples of fermented honey by any of the foregoing methods were placed under various conditions to incubate.

1.—At room temperature and at 82°F.

2.—In Anaerobic jars at room temperature and 82°F.

3.—Under vacuum at room temperature and 82°F.

Within five or six days, those dishes incubated at room temperature and also within two or three days the ones at 82°F. began to show growth. Small round white colonies became visible. A microscopic examination proved these colonies to be yeasts. No growth at all was noticed on the plates incubated in anaerobic or vacuum jars.

These operations were repeated many times, using different samples of fermented honey from various sources and each time yeast colonies were the only organisms that grew. Thus, we can safely say that the fermentation or souring of honey is undoubtedly caused by yeasts. So far in the work, five strains of yeasts have been isolated from fermented samples of honey. All are able to grow in very concentrated solutions of honey. Further analytical methods, however, will have to be employed before we can state definitely whether these strains are entirely distinct species.

Giant colonies have been grown from each yeast. In raising giant colonies, 100 cc. Erlenmeyer flasks were used. Fifty cc. of honey-yeast water-agar medium was put into each flask, after which they were plugged and sterilized. A sterilized needle was used to fish off a colony from the petri dish and the center of the hardened sterile medium was then touched with this needle. Within a day or so growth began to appear. In about two months, the colonies would be from one to one and one-half inches in diameter.

This procedure was followed in raising several hundred colonies, and out of the whole number only five distinct forms appeared which are shown in the following plate.

Experimental Results

1.—All of the five yeasts isolated from fermented honey ferment glucose, levulose and mannose. Strains A and C ferment sucrose, while the latter also ferments maltose

The following sugars were used:—

A.—Pentoses: zylose
B.—Hexoses: glucose, galactose, mannose, levulose
C.—Disaccharides: sucrose, maltose, lactose
D.—Trisaccharides: raffinose, melezitose

The fermentation was carried on in test tubes with 10 cc. of a 10% sugar solution in each tube.

2.—The five strains of yeasts can be separated into three groups relative to ring formation in a flask of fermenting wort. Strain A forms a very light ring; Strains 1, 1A and B form a medium heavy ring while Strain C forms a very heavy ring.

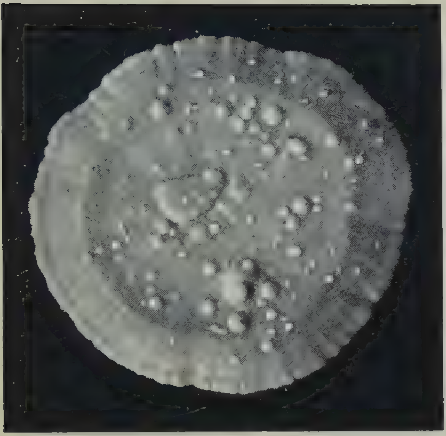
3.—Moisture determinations were made on various samples of fermented honeys and on one unfermented. The crystals and liquid part were separated and determinations made on each.

Sample	I—A fermented honey which was granulated	26.6 %
"	II—A liquid sample fermenting in the comb. The cells were uncapped	28.5 %
"	III—Granulated, fermented honey	20.7 %
"	IV—Unfermented—Coarse crystallization	16.3 %
"	V—The crystals separated from Sample IV	11.75%
"	VI—The liquid part separated from Sample IV	20.8 %

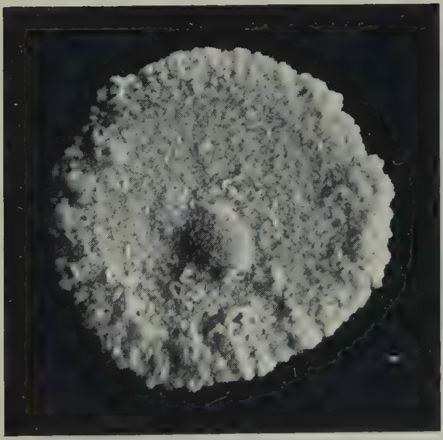
4.—From experiments carried on so far, it appears that yeast cells are found in almost all honeys and when they are diluted, fermentation sets in. We know yeasts are very widely distributed everywhere in nature and apparently they find their way onto the pollen and into nectar and are so carried to the hive by the bees. A recent experiment shows that pollen stored within the hive contains large numbers of yeasts.

On microscopical examination of honeys, many grains of pollen are apparent. During the process of the ripening of honey, the yeasts cells are not killed and are so found in most honeys in a dormant state. When the right conditions are brought about in the honey, the yeast cells begin to multiply and so cause the honey to ferment.

5.—Honey heated to 160°F. does not ferment, due to a killing of the yeasts. Within two months, an active fermentation had set in in those not



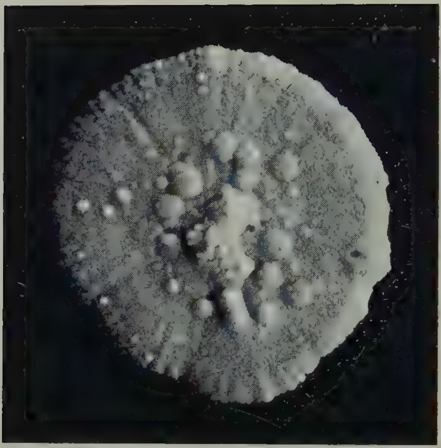
STRAIN I.



STRAIN IA.

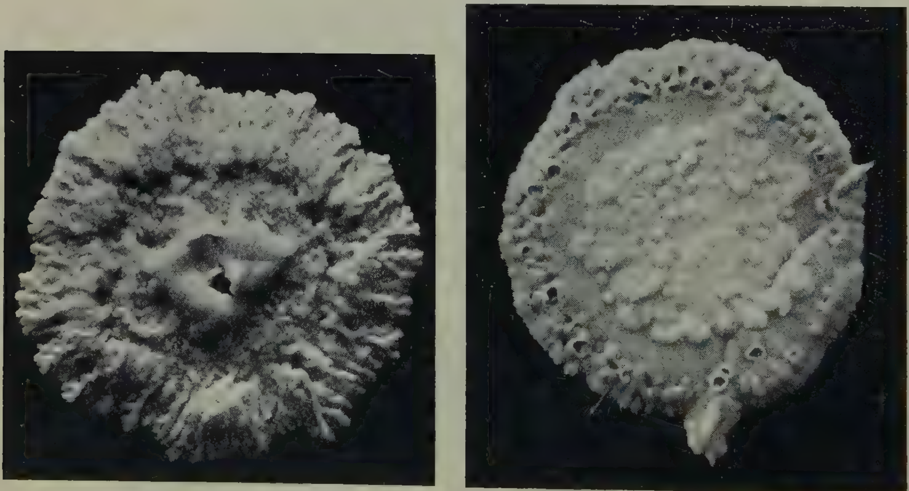
Both giant colonies enlarged two diameters.
Age two months.

PLATE II



STRAIN A.

Two month old giant colony enlarged two diameters.



STRAIN C.

STRAIN B.

Two month old giant colonies enlarged two and one-half diameters.

heated. These samples were extracted early in the season, before the bees had fully capped the cells and had sufficient time to ripen the honey. This also shows that yeast cells are present in honeys when taken from the hive.

6.—Fermentation can also be prevented by keeping honey at 52°F., for at that temperature the yeasts will not bud or grow.

7.—Pollen stored in the combs within the hive contains large numbers of yeast cells, so if much pollen is found in the honey, yeast cells are almost certain to be there, also.

How Yeasts Are Studied

The various yeasts are studied in water mounts stained with Rose Bengal. Vaseline is placed around the sides of the cover slip to prevent drying out.

Summary

Fermentation of honey is caused by yeasts. Yeast cells appear to be in most honeys and when osmotic pressure on the cells is decreased, they begin to grow, causing a souring or fermenting. Alcohol and carbon dioxide are given off in the process. By heating honey to 160°F., and pailing while hot fermentation can be completely prevented. Honey which is thoroughly capped is not proof against fermentation.

Fermentation of honey is a very serious problem among Wisconsin beekeepers. Up to the present time, only three species of honey yeasts have been described, all of these in Europe.

In the present work, we have found what appears to be five distinct strains or species. These five strains have been indicated by the following: Strains I, IA, A, B, C. Giant colonies are shown in the accompanying plate.

◆

Suggestions in Making Whole Chick Embryo Mounts*

DONALD G. BARTON, *U. New Hampshire* (*Phi*)

AS a result of considerable experimental work, the following methods are suggested in the field of chick embryology: 1. A better method for removing embryo. 2. Use of paper ring to prevent wrinkling 3. Use of Carmalum as a stain. 4. Clearing in euparal to prevent shrinkage.

There is, perhaps, no more careful work required in Embryology than in the preparation of whole chick embryo slides. Students find several steps in the process extremely difficult to manipulate. The first difficulty is met when the embryo is removed from the egg. The general practice is to attempt to transfer the chick directly from the surface of the yolk to the watch crystal. This method always requires much time to remove the yolk and the vitelline membrane. The embryo is very often broken by the time these two things have been accomplished. These difficulties may well be avoided by following the procedure described below and the number of embryos successfully removed from the egg will be decidedly increased.

Have the following apparatus at hand: a pair of curved scissors, a pair of curved forceps, two pipettes one curved and one straight, a thoroughly clean watch crystal, a Petri dish and cover, two dishes, one for waste and the other filled with cold water not over three inches in depth, and large enough so that a watch crystal can easily be handled in it, a ring of paper toweling one and one half inches in diameter with the center cut out large enough to expose the embryo, and the fixative which should be ready for immediate use.

Remove the egg from the incubator keeping it on its side and with the scissors remove a small amount of the shell from one end. Do not insert the scissors into the egg any farther than necessary to avoid puncturing the yolk. With a pipette draw out a considerable amount of albumin always keeping watch for the chalaza. Do not draw this into the pipette because it is liable to break the yolk. Cut around the upper third of the shell and remove it. Care must be taken not to puncture the yolk. Lower the egg into the dish of water and carefully empty the contents.

The embryo is usually clearly seen on the upper surface of the yolk. If it has turned under upon being emptied into the water, grasp the chalaza and turn the yolk over, with the forceps. With the embryo on the upper surface, cut around outside the area vasculosa with the scissors, beginning on the lower margin so that the embryo will not fold over on itself. Be sure that the incision is complete. Grasp one edge of the cut membrane and carefully pull the chick into clear water. Yolk will very seldom adhere to the under side of the embryo but if it does the chick should be gently moved about in the water until it is clean. It is best not to try to remove the vitelline membrane until the chick is on the watch crystal.

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* Contribution Number 5 from the Zoological Laboratory, University of New Hampshire, Durham, N. H.

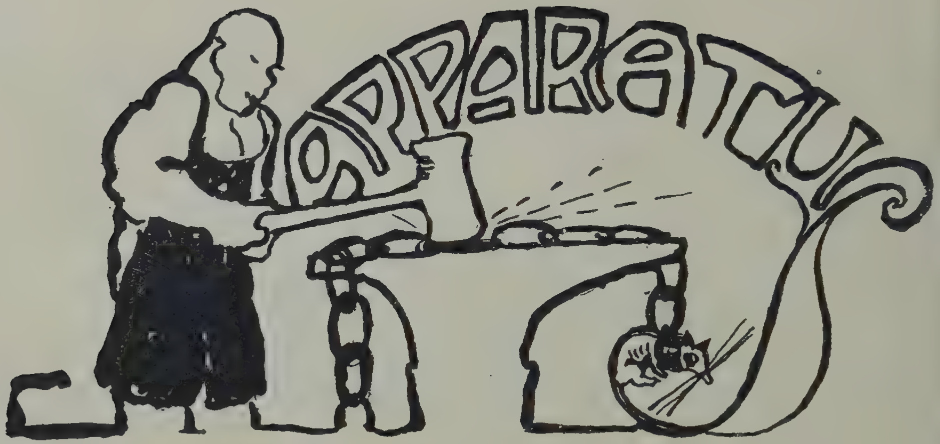
The watch crystal is lowered by the left hand into the water keeping it flat and the convex side uppermost. Grasp the area vasculosa with the forceps and gradually draw the embryo on to the watch crystal. Slowly lift the watch crystal out of the water keeping close watch of the embryo to see that it does not float away. If it appears folded, slowly submerge and lift it out again. The vitelline membrane can now be removed with forceps adding, if necessary, a little water with the pipette. The embryo appears flat on the watch crystal but be sure that every fold is smoothed out before the paper collar is adjusted.

Wet the paper collar in the water and place it on the embryo so that the rim of the collar is in contact at all points with the vasculosa. This prevents the shrinking and wrinkling effects of the fixing agent. Place the watch crystal in the Petri dish and flood it with the fixative. Draw out the air from under the watch crystal with the curved pipette. After fixing, the embryo may be removed from the watch crystal and may be allowed to rest on the bottom of the dish.

The most satisfactory stain for regular work is carmalum. It should be diluted if left over night because it is hard to de-stain.

Breaks and wrinkles are common imperfections found in the completed slide. These are caused either at the time of fixation or by xylol. Although the embryo may pass the first danger successfully it is not unfrequently damaged by the clearing agent. Xylol tends to make tissue brittle and if the student does not use extreme care the embryo will be broken in transferring it to the slide. To avoid the use of xylol another clearing agent has been substituted. It is first necessary to thoroughly de-hydrate with 100% alcohol and then to transfer the embryo into euparal for only a few minutes ranging from three to fifteen according to the size of the chick. As soon as cleared transfer to a slide. This is best accomplished by placing one end of the slide into the euparal and drawing the embryo up the inclined plane. Add thick balsam and cover glass or not as indicated by the size of the chick.

By the use of the above method, twelve and fourteen hour chicks can be easily mounted free from the usual breaks and wrinkles. The procedure as given does not include all of the steps in making the slide such as de-hydration, fixing and washing have not been listed. These steps are found in any embryological procedure.



Glass Blowing For the Laity

Frank Leigh Robeson and Everett F. Davis (*Mu* '24)

MANIPULATING glass to make or to remodel laboratory apparatus has been an art since the time of the earliest alchemist. As with any art, there have been few to master the technique completely. As any other art, however, it is indulged in by many. Some persistence with constant practice when applied to the manufacture of implements of glass for the biological laboratory will invariably result in a perfection of skill quite sufficient to give the average worker a particular advantage over his fellows and to enable him to put many of his own ideas into concrete form.

Call it a weakness if you will, but the present writer with very little skill has found himself drawn to glass, the material, and to the blowing of glass as a means of devising simple bits of apparatus for methods of approach to certain physiological problems which would have been otherwise totally neglected. The experimental physiologist, whether in animal, human or plant physiology, should be able, I believe, to manipulate glass tubing of ordinary dimensions with a fair degree of assurance that he can produce within a reasonable time any desired result.

If inclined to doubt the wisdom of the above statement, consult the list of 42 scientific departments, designated officially by the National Council of Phi Sigma as embracing all the legitimate fields for membership. Of this number, in how many instances will you agree that a knowledge of glass blowing would benefit the laboratory man in certain types of investigations? In the opinion of the writer the answer should be nearly twenty. Among the agricultural chemists, the agronomists, bacteriologists, biochemists and the physiologists there is an urgent need for certain individuals to acquire the technique as also in the studies of soils, zoology and of botany.

This being the case there seems some reasonableness to a demand for an apology for bringing some of the working principles of the methods of blowing glassware to the attention of the readers of The Biologist for their study and possible application. The authors, one Professor of Physics at the Virginia Polytechnic Institute, the other your editor, are duly aware that in no sense can any outline of directions or list of suggestions of our preparation tell you just how to proceed and how not to proceed quite as efficiently as some capable instructor by your side. It is our hope, however, that the present description of a method for making an automatic self-starting siphon from a straight tube of soft glass with a bore having an internal diameter of 2.54 cm. and 1.5 mm. thick will interest some and serve as a guide for making this useful article for the biological laboratory.

The permission to use the cut in this article illustrating the completed siphon was granted through the courtesy of the Chicago Apparatus Company who manufacture and sell the Milvay Scientific Instruments. It was taken from their catalog No. 38, page 197. The siphon can be supplied by them, ready for use, at a cost of $1.50 each.

We shall include in the first place a brief statement of the methods followed by an appendix of guide rules so that the uninitiated will be encouraged to try a hand at what may later prove to be for him or her a useful and important avocation.

If you had followed Professor Robeson in all his movements you would have seen him first give critical examination to his stock of materials, a large assortment of glass tubing varying widely as to kind and shape. The piece selected for this lesson had to conform to certain standards regarding uniformity of bore and wall thickness, degree of hardness and ability to fracture crosswise evenly and without undue irregularity. As we have mentioned previously, certain details must be omitted from this discussion and some of these will be supplied after a brief outline of directions has first been given.

The Method

Preliminary

Before proceeding to draw down the big tube which was cut to about 25 cm. in length, to form a small tube at each end, Doctor Robeson first concentrated his attention upon the flame. A clear blue brush flame about ½ inch in diameter was directed then upon one end of the tube using an air blast from an electrically driven rotary blower and vacuum pump.

A piece of glass tubing of 1 cm. diameter, 10—15 cms. in length, was temporarily joined to the end of the large tube for a handle and allowed to stiffen. A pointed flame was directed against the edge of the large tube just back of the union with the handle and its molten periphery was pushed through the radius of the large tube into a central position and allowed to stiffen. By this means a handle was obtained thereby assisting the rotation of the large tube about its axis.*

Contracting the Large Tube, I—

To contract the big tube the flame was applied at a distance of 2 inches from the temporary handle and with constant rotation the walls of the tube were slowly allowed to collapse evenly from all sides without the slightest pull being exerted by the hands at either of the ends. Stiffen by taking out of the flame, reheat uniformly and lengthen the neck by slightly pulling at the ends.

If executed correctly the end of the tube should present the appearance shown in the diagram A, Fig. I, with the diameters of the large and small tube approximating the ratio 1 to 3/8. If the angle through which the attenuation was carried is entirely satisfactory it may be recognized by its freedom of bumps, the smoothness of curve and by a sensibly circular opening at *a*. A sudden and acute angle is not desired at the point of the arrow in the diagram. Partially anneal in a smoky flame before proceeding with the next step.

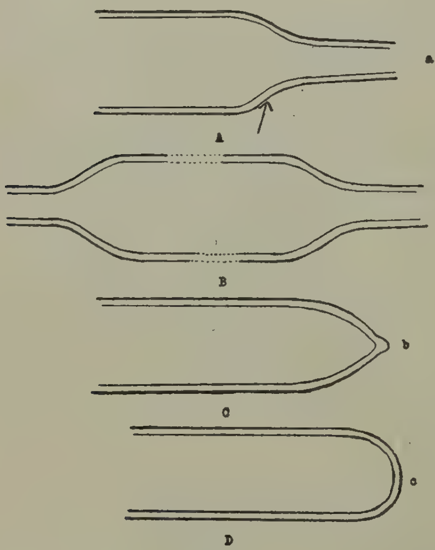


FIG. I

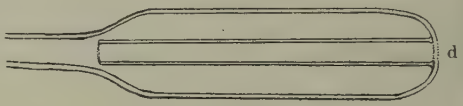


FIG. III

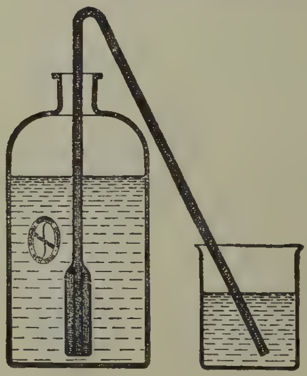


FIG. IV
Automatic Self-starting Siphon
(*Courtesy of Chicago Apparatus Company*)

II—

Proceed as before with the contraction of the large tube, now working near the middle of its original length so as to form a barrel for the siphon 8 to 9 cms. in length with a diameter of 2.54 cms. between two contracted ends of the large tube as shown in diagram B, Fig. I. Stiffen, reheat the neck at a point about 2 cms. from the uncontracted part of the barrel. Allow the walls to collapse evenly by rotating in a flame which you had previously adjusted to be a little wider than the diameter of the neck at this point. Care must be taken so that both hands rotate at the same time and same rate of speed or the soft glass will be twisted out of shape while in the flame. When the glass is viscous, take it out of the flame and quickly draw off that portion of the large tube from the barrel of the siphon which has served as the other handle. In this manner you are successfully rid of the excess tubing and the burden of operating the barrel of the siphon in the flame is considerably reduced. Now increase the diameter of the blast to conform with the diameter of the barrel. Seal the end of the barrel by rotating the tube in the flame. The closed end should have the appearance shown in diagram C, Fig. I, at *b*. Stiffen and then remelt the glass at the sealed end, swell it out evenly, gently blowing from the mouth, taking care to remove the glass from the flame as you blow. When finished the end should correspond to diagram D.

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* The glass should be rotated steadily and constantly while heating, but not necessarily rapidly.

Piercing the Tube, III—

Pierce the end of the barrel at *c* in the following way. Soften the glass with a small round pointed blast concentrated centrally on the end just sealed. When the glass is soft expand the tip according to the stages shown in diagrams A, B, C, D, of Fig. II. Instead of leaving the bulb to be broken at the third stage (C), blow the next time more strongly so that the bulb becomes very large, thin, and at the same time bursts. The removal of the thin glass is then accomplished and the part is reheated below its melting point in a large cool flame to remove the tension caused by piercing the hole. Cool in a smoky flame. The hole should have a diameter not less than .10 mm. and should be circular in shape.

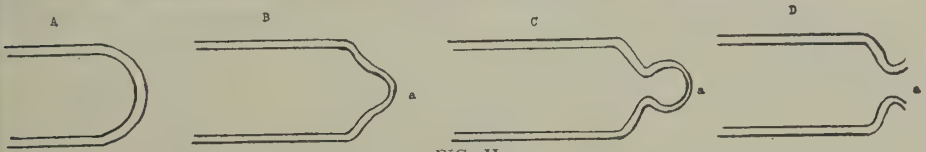

FIG. II

Grinding, A Preliminary to Welding Strong Joints, IV—

Grind the rim about the hole down smooth by rubbing it with a circular or gyroscopic motion against a thick piece of plate glass, using a grinding paste consisting of powdered emery or carborundum moistened with some water or better some turpentine. Grind the other end in the same manner.

Rounding or Bordering the End of the Inside Siphon Tube, V—

Having selected a glass tube for the inner tube of the siphon of a diameter between 6-7 mms., satisfy yourself that its composition is such as to conform to the hardness of the glass used in making the barrel.* The length at first should exceed the length of the barrel of the siphon.

Soften the end of one end of the tube in the blast flame and border it by turning it uniformly over the surface of the cone shaped end of a carbon rod. Form a rim at right angles to the sides of the glass tubing sufficiently large to prevent its being passed through the centrally located hole at end of the siphon barrel. See that the rim fits snugly against the edge of the hole and that the former covers the hole completely on all sides.

Welding the Inner Tube to the Barrel, VI—

Cut the length of the inner tube so that when fitted temporarily within the barrel in a plane perpendicular to the table top, there will be a distance of about 5 mm. separating the outer edge of the lower end of the inner tube from the inner wall of the neck. It is this distance which to a large extent determines the efficiency of the siphon in liquids of different viscosity and density.

Prior to welding the inner tube to the barrel at *d* Fig. III, steps must be taken to plug the lower end of the inner tube. Furthermore, it is necessary to hold it rigidly in place so that a proper distance between it and the inner wall of the contracted barrel can be maintained during the welding process.

One method which Professor Robeson has used effectively is to plug the inner tube with a square piece of soft wood shaved round at one end to make a snug fit; or instead, a No. 0 cork, 6—7 mm. diameter, can be pinned on to the end of the square plug to cork the inner tube. He says, ''This is one place where you want a square plug in a round hole.'' The square end of the plug is cut so that its corners will make a contact with the inner surface of the neck of the barrel in four places where a good contact has already been established at the opposite end of the inner tube between the rim and the margin of the hole.

When sufficiently heated, apply the pointed flame of your blast where the union is to be effected. Make a uniform seal about the entire circumference, ''working'' the joint by softening and allowing the glass to stiffen and soften repeatedly. During this operation a very gentle pressure from the mouth should be applied inside the barrel. Attach a rubber tubing to the neck of the barrel and pump the air in one gentle continuous blast, while the glass is out of the flame. Test for air leaks about the union by blowing occasionally when the glass is stiff. The blast of air escaping from the leak can be readily seen in a flame. By ''working'' the joint a blend between the two kinds of glass is achieved, an end which must be accomplished before a permanent and trustworthy joint can be secured. At this point see whether or not the distance between the inner tube and the neck of the siphon has seriously diminished during the welding. Anneal very gradually through a hot and cold smoky flame for a period of fifteen or twenty minutes. See Fig. IV for the siphon assembled and complete.

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* As far as possible it is best to make the entire apparatus from the same piece of tubing, as one is then sure of having glass of the same hardness throughout.

Remove the plug, select a straight piece of glass tubing 40 cms. in length, more or less, depending upon requirements for which the siphon is to be used. It should have a total diameter the same or nearly equal to the diameter of the siphon tube which should approximate 9 or 10 cms. If a hand blow-torch is among your equipment attach the gas and air blast supplies to it in preference to the blast burner which you have been using. Secure the barrel of the siphon in a vertical position clamped to an iron ring-stand at a convenient working distance above the table top. Clamp the siphon tube above the siphon barrel in such a way as to exert pressure upon the neck. Adjust the torch but before using it anneal the glass well with an ordinary bunsen burner. Apply a small pointed blast from the hand torch, gradually circling the tubes at their junction as the union is made. It should not be necessary to use an oxygen flame but if necessary in order to increase the temperature of the glass to the melting point, use a tank of compressed oxygen instead of the air blast supply. Anneal as before, using a bunsen flame.

Bending the Siphon Tube, VII—

Having completed all the various operations in the manufacture of the automatic self-starting siphon save bending the siphon tube, you will not find this last procedure a very difficult one.

Heat the tubing gradually in a large brush flame at a distance between 10 and 15 cms. above the last made joint. When the tube is hot enough to bend, begin at the 10 cm. point and bend over a distance of about 5 cms. Direct the tip of the siphon tube downward with the right hand, holding the barrel in the left hand on a level with the shoulders. Sight with the eye to see if the bending is carried on in one plane with the barrel and stem of the siphon. When finished the tube should make a 30 degree inside angle with the stem of the siphon.

Appendix

Hints for Blowing Glass

Blow-pipe Flames

The Pointed Flame.—Characterized by a long tongue of flame ending in a fine point, quite free of luminosity. The amount of air as compared with the proportion of gas, is large. The part of the pointed flame to be used in glass working is the tip, or in some cases the space slightly beyond the tip.

The Brush Flame.—Characterized by its semblance to a large camel's hair brush, large size, non-luminous. A liberal supply of air is mixed with an abundance of gas. This flame is often invaluable.

The Smoky Flame.—Characterized as an illuminous flame which smokes the glass with carbon from incompletely combusted gas. A very free supply of gas with only enough air to give an outward direction to the burning gas is needed to give the smoky flame. Useful in cooling as in annealing, or for heating slowly.

Implements—Equipment

Corks of various sizes, triangular and other files, a carbon stick tapered by grinding each end into (1) a long narrow cone, (2) a cone brought to a point more suddenly, fine and coarse emery or carborundum powder, cotton batting, rubber tubing, pair stout tweezers for pulling off melted glass, turpentine for mixing grinding paste.

The Glass—its Quality

Bending glass is a soft glass, commonly called "soda glass." Good glass tubing is characterized by freedom from knots, air-bubbles and stripes. It should be of uniform thickness and cylindrical bore. If a glass tube cracks regularly when a sharp transverse scratch is made with a good file and it is touched with a melted glass bead formed on the point of a finely drawn out piece of tubing, the glass is said to be annealed properly and is suitable for glass blowing purposes.

The greater the diameter and the thicker the glass is, the more readily it will crack when brought into a flame suddenly.

Glass-Blowing Operations

1. The annealing operation is very important when unions have been made or when glass has been twisted or bent at sharp angles.
2. In operations involving blowing out viscous glass, attempt to blow the glass at a low temperature before higher ones are tried.
3. Keep the flame adjusted so that it is slightly larger in diameter than the tubing which is to be heated.
4. Much less heat is needed to bend glass than is necessary in order to blow it. Use the lowest temperature which will meet these requirements.
5. Learn to rotate evenly; both hands rotating together and not separately, in order to heat all parts uniformly without applying a twisting motion.
6. Remember that it is rarely safe to blow glass while it is still in the flame.
7. When welding two glass parts together it is necessary to "work" the glass, i.e. soften, stiffen, and repeat the operation a number of times.
8. Always blow gently at first, and slowly increase the force applied until you feel the glass giving away.

Principle of The Automatic Self-Starting Siphon

When the siphon barrel is immersed in the liquid to be siphoned over, the inner tube overflows and the liquid runs back, trapping the air in the space between the inner tube and the inner wall of the barrel of the siphon. The air being lighter than the liquid is forced upward into the column of liquid in the bent siphon tube. It is the lifting power of this column of air bubbles and the pressure of air behind it that forces the liquid past the bend in the tube, a process which starts the siphon to act.

References

Shenstone, W. A. The Methods of Glass Blowing. Longmans, Green and Company, New York. 1902.

Scientific Papers

List of scientific papers read at the meetings of the American Association for the Advancement of Science at Nashville, Tennessee, December 26-30, 1927, by *University of Kansas* people. Two of the departments of biology were represented at these meetings. (Headings indicate society before which the paper was read.)

Entomological Society of America

"The genus Driotura and the new genus Unoka (Momoptera, Cicadellidae)," by Professor Paul B. Lawson, Ph.D.

"Some recent studies in aquatic Hemiptera—(including a new sub-genus and a new species)," by Professor H. B. Hungerford, Ph.D.

"Studies on the biology of the genus Corizus," by Asst. Professor Phillip A. Readio, Ph.D.

"Studies on Kansas Cicadas," by Asst. Professor Raymond Beamer, Ph.D.

American Society of Zoologists

"Spiral movement in Man," by Professor A. A. Schaeffer, Ph.D.

"The effect of temperature on the rate of movement in the marine ameba, *Mayorella conipes*," by Fred W. Allen, Jr., Graduate. (Introduced by Dr. H. H. Lane.)

The above are all of the papers read by our people at the meetings of A.A.A.S. But of equal importance and interest are some papers that have been read or are to be read in the near future by some of the members of some of the other departments of biology. A number of the members of the Department of Bacteriology had papers at the meeting of the Society of American Bacteriologists at Rochester, Minnesota, December 27, 28 and 29, 1927. They were:

"The effect of urea on living cells," by Professor Noble P. Sherwood, Ph.D., and Frances Dunmire, Graduate.

"A study of the blood groups among Polynesians," by Miss Clara Nigg, Instructor.

"A study of Isohemolysins," by Associate Professor Cora Downs, Ph.D., Kenneth Koerber, Graduate, and H. P. Jones, Assistant.

There will be a meeting of the Association of American Anatomists at Ann

Arbor, Michigan, at Easter time. One of the faculty members of our department of Anatomy will have two papers to read at this meeting. They are:

"The post-natal growth in the length of the pharynx of the Leghorn chicken," by Professor H. B. Latimer, Ph.D.

"Growth changes in the body and some of the organs of the chick at time of hatching," by H. B. Latimer.

Scientific Papers Presented at Nashville, Dec. 26-30

By Members of Iota Chapter

Dr. Caswell Grave, Rebstock Professor of Zoology—Duration of the Larval Life of Ascidians—Am. Soc. Zool.

Dr. Harry M. Miller, Jr., Asst. Prof. of Zool.—Variety of Behavior of Larval Trematodes (Carcariae)—Am. Soc. Zool.

Dr. Harry M. Miller, Jr., Asst. Prof. of Zool., and Charlotte W. Dawley—Some Effects of *Cysticercus fasciolaris* Rud. on the White Rat (*Mus. norv. alb.*)—Am. Soc. Zool.

Oliver R. McCoy, former Asst. in Zool.—Life History Studies on Trematodes from Missouri—(By title)—Am. Soc. Parasitologists.

Dr. W. W. Lepeschkin, Visiting Prof. of Plant Physiology—The Effect of Alcohol on the Turgor Pressure of *Spirogyra*—Sect. G., (Bot. Soc. of America, Am. Phytopath. Soc. and Am. Soc. Plant. Physiol.)

Dr. C. H. Farr, former Assoc. Prof. of Bot.—Morphogenetic and Nuclear Behavior of Root Hairs in Solutions—Bot. Soc. of America, general sect. The Elongation of Root Hairs in Solutions of Single Calcium Compounds—A Comparison of Three Species: *Brassica oleracea; Avena sativa; Oryza sativa.*—Bot. Soc. of America, Physiol. sect.

Mildred E. Mathias, Jessie R. Barr Fellow in Botany—A Taxonomic and Geographic Study of Glehnia, a genus of the Umbelliferae—Bot. Soc. of America, Syst. sect.

R. E. Woodson, Jr., former Rufus J. Lackland Fellow in the Henry Shaw School of Botany—A new genus of Berberidaceae—Bot. Soc. Am., Syst. sect.

Dr. J. M. Greenman, Prof. of Bot.—A new Senecio from Western Virginia and Eastern Tennessee—Bot. Soc. Am., Syst. sect.

Dr. Edgar Anderson, Asst. Prof. of Bot.—The Problem of Species—Bot. Soc. Am., General sect.
A Naturalist's Pilgrimage to Canterbury—Am. Nat. Study Assoc.

Dr. Frank B. Hanson, Prof. of Zool.—Effect of X-Rays on Productivity and the Sex Ratio in *Drosophila melanogaster*—Genetics Section of Am. Soc. Zool. and Bot. Soc. Am.

Dr. R. J. Terry, Prof. of Anatomy—A Table Designed for Use in Photographing and Measuring Cadavers—Anthropology—Sect. H.

Dr. Mildred Trotter, Asst. Prof. of Anatomy—Hair Growth and Shaving—Sect. H.

Dr. John C. McGeoch, Assoc. Prof. of Psych.—The Reliability of Nonsense Syllable Learning by the Anticipation Method—Sect. I., Psychology.

List Papers Read by Biologists From the University of Wisconsin at the Meetings of the A. A. A. S., Nashville, Tenn., December, 1927

Entomology

Read to Society of Economic Entomologists

Granovsky, A. A., (Asst. Prof. Entomology). Alfalfa Yellow Top and Leafhoppers.

Marvin, G. E., (Instructor in Entomology). The Cause of Fermentation or Souring of Honey.

Horticulture

Read to the American Society for Horticulturists

Finch, A. H., (Instructor in Horticulture). Notes on the Physiology of Apple Varieties.

Roberts, R. H., (Assoc. Prof. of Horticulture). Further Notes on Apple Stocks.

Watts, V. M., (at Fayetteville, Ark. now). Reaction of Tomato to Varying Light and Nitrogen Supply.

Plant Pathology

Papers read to American Phytopathological Society

Banfield, W. M. Studies of the Life History of the Crown Gall Organism.

Doolittle, S. P. (U.S.D.A.) and *Walker, M. N.* (U.S.D.A.). Aphis Transmission of Cucumber Mosaic.

Doolittle, S. P. (U.S.D.A.). Soil Transmission of Tomato Mosaic and Streak in the Greenhouse.

Duggar, B. M., (Prof. of Physiological and Applied Botany). Recent Viewpoints and Evidence Tending to Characterize the Agencies of Typical Mosaics.

Fajardo, T. G., (Graduate student). Progress on Experimental Work with the Transmission of Bean Mosaic.

Gardner, M. W., (Indiana Agr. Exp. Sta.). Sporotrichum Fruit Spot of Apple.

Hamilton, J. M., (Asst. in. Plant Pathology) and *Keitt, G. W.* Studies of the Action of Certain Sulphur Fungicides in Apple Scab Control.

Jones, L. R., (Honorary member) (Prof. of Plant Pathology) and *Riker, Regina S.* Studies on the Fusarium Wilt of China Aster.

Montieth, J., (Asst. Pathologist) and *Dahl, A. S.,* (Asst. in Pathology). Mercury as a Control of Turf Diseases.

Montieth, J. Leafhopper Injury of Legumes.

Riker, A. J., (Research Asst. in Plant Pathology) and *Banfield, W. M.* (Asst. in Plant Pathology). Studies of the History of Development of Wound Overgrowths on Apple Grafts and of the Influence of Wrappers on their Suppression.

Riker, A. J. Correlation of the Wound Overgrowth and Crown Gall Situations in Parts of Europe and of the United States.

Riker, A. J. A Bacterial Disease of Broad Beans.

Walker, J. C., (Assoc. Prof. Plant Pathology) and *Wellman, F. L.* A Fusarium-Resistant Cabbage of Jersey Wakefield Type.

Wellman, F. L., (Asst. in Plant Pathology). The Reaction and Treatment of Soils Infected with *Plasmodiophora brassicae* (Wor.).

Wilson, E. E., (Asst. in Plant Pathology). Factors Important in the Development of Perithecia of *Venturia inequalis.*

Keitt, G. W., (Prof. of Plant Pathology) and *Wilson, E. E.* Fall applications of Fungicides to Apple Scab Control.

Plant Physiology

Papers read to American Society of Plant Physiologists

Dickson, J. G., (Prof. of Plant Pathology). The Relation of Temperature to Disease Resistance in Plants.

Janssen, George, (Univ. of Ark.). A Study of the Effect of Date of Seeding of Winter Wheat on Plant Development and Physiological Activities in the Dormant Season and Their Relation to Winter Hardiness.

Tottingham, W. E. and Lowsma, H. W., (Asst. in Agricultural Chemistry). Relations between Quality of Light and Nitrate Assimilation in Wheat.

Zoology

Papers read to American Society of Zoologists

Gray, I. E., (at Tulane Univ.) The Effect of Insulin on the Blood Sugars of Fishes.

Hisaw, F. L., (Assoc. Prof. Zoology). Experimental Relaxation of the Symphysis Pubis of the Guinea Pig.

THE GRIST WE GRIND

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Titles of Papers reported in progress of completion by members of PHI SIGMA.

University of Washington PSI

Rebecca Banks—Ecology of Geyser Basin.

Julia Goodsell—Influence of iodine on the colloidal substance of the thyroid of a guinea pig.

Helen Hart—Germination and causes for delay of, in seeds of *Celastris scandens* and *Peltandra virginica.*

John Lucker—Trematodes of Freshman Basin and Lake Washington.

Emma Jo Stewart—Putrefaction of meat.

L. D. Van Tilborg—Fish Trematodes.

Dorr Yeager—The genus Clitocybe.

University of Oklahoma OMEGA

Lois Gould—A comparison of dates of first blooming of flowers in the Middle West.

Dixie Young—Early embryology of the scorpion, with particular reference to the tracing of the germ cells.

William H. Bayliff—Embryology of Bcellodrilus.

A. Richards—The inadequacy of the chromosome mechanism; Mitotec index of honey-bee larva; Cytological studies on hibernating animals; Textbook of comparative embryology.

Leona M. Gilmore—Insect galls of Oklahoma.
Rufus Henry Moore—A study of the secretory cells of the essential oil of the green corn plant.
Phyllis Draper—Investigation of fossil pollens in Oklahoma peat bogs.
Herbert E. Warfel—Cytological study of hibernating gophers.
Peggy Paddock—Rate of body growth of the honey-bee larva.
Margaret Celeste Whaley—Spermatogenesis of the cotton boll weevil (*anthonomous grandis*).
Aaron J. Sharp—Anatomy of sorghum mosses of Oklahoma.
A. O. Weess—Bioecology.
I. J. Myers—Life and food habits of the *geococcyx californias*.
R. E. Jeffs—Toxonomic work on the flora of Oklahoma.
B. F. Wolf—Native plants of Oklahoma for landscape uses.

University of Southern California ALPHA ALPHA

J. Leroy Arnold—Survey of Mollusca of Anaheim Bay.
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Charles D. Buck—Fish of Anaheim Slough.
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R. S. Denman—Fishes of Anaheim Slough.
Earl K. Fischer—The synthesis of saturated furfural derivatives.
Dorothy Remaley Harvey—Plankton study, Mission Bay, San Diego California.
Lena Higgins—Crustacea studies of Anaheim Slough.
Andrew J. Hoefer—Aymbiotic relationships between bacteria and protozoa.
Gregory M. Kranzthor—Herpetological studies of Los Angeles region.
Marcia Lucille Lange—Relation of *Oidium albicans* to certain foods.
Elvira Seed Lee—Shell study of Pacific Coast.
Miss Archie MacLean—Annelida of Anaheim Slough.
Eunice Mason—Plankton study of Anaheim Bay.
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Hollis E. Sides—A study of certain aspects of the nervous impulse.
Charles Oliver Sycour—Giardia (Lamblia) Intestinalis.
Ruth C. Van Vleet—Study of Coelenterata of Anaheim Slough.
H. T. White—Bryozoa of the Georgian Bay region.

University of Maine DELTA

Dr. Kenneth S. Rice—Studies in permeability.
Dr. Donnell B. Young—Colony formation in certain encrusting Bryozoa.

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